THE MARINE REVIEW

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SHIPPING WORLD YEAR BOOK.

The Shipping World Year Book, edited by Major Jones and published by the *Shipping World*, London, is out for 1906. This book is a port directory of the world and is now in its twentieth yearly edition. Major Jones is always interesting and his retrospective view of 1905 while briefer than for most years, is well worth reading. In it he says:

"The year 1905 has been a remarkable one for ship owners and charterers. Freights have been high, low and subject to much variation in most of the markets. But 'It might have been worse,' may be accepted as the composite verdict of British ship owners upon the old year. The highways and healthy developments of commerce have, as must ever be the case, been hindered and disturbed by the war. Ships were required to coal the fleets, to run blockades, and carry contraband of war to either or both of the belligerents. But the ubiquitous collier often found the cruisers of Japan and Russia in waiting to capture or sink her. In this way tonnage measuring about 80,000 tons, valued at nearly £1,500,000, was removed from the British register. The Peace of Portsmouth, the homeward transportation of the armies of the Czar, the civil war in Russia, and the ratification of the treaty between China and Japan, with its 'open door,' have served to improve or depress freights; but the dividends on the whole were comforting. Again, the returns of the Board of Trade, as well as the reports and balance-sheets of our great industries, especially in cotton fabrics, iron and steel, machinery and ship building, have enjoyed a great prosperity both in the home market and the export trade.

"For example, our yards put more tonnage into the water during 1905 than in any previous year, the total being 1,744,402 tons, against 1,405,633 tons launched in 1904. The contribution of the private yards aggregated 1,698,152 tons; that of the dockyards 46,250 tons. Out of this total about 1,318,102 tons go to swell the British merchant fleet, already substantially greater in carrying power than the combined mercantile marine of all foreign countries, and embracing turbine vessels of larger size, and the highest speed, suited for every variety of trade.

"Prices were never so low. New steel cargo boats were built by good firms for £5 5s per ton. Old tonnage launched in the seventies changed hands at 35s a ton, and fine wood-built ships were sold as low as 20s a ton. These prices were never known before; several years must elapse before they return.

"The reciprocating engine has departed for whole classes of ships, probably never to return. The minds of engineers are turning to the other necessity of marine propulsion, viz., the boiler; and progressive engineers dream dreams of a turbine ship without boilers. For this achievement the gas turbine would be necessary, and this is not yet within range. The power of the petrol engine for marine work is gradually rising, and for small work and lighters there is an enormous field for this reliable motor. The gas engine with plant for producer gas has been in operation for land work up to, say, 5,000 I. H. P.; but there are certain inherent disadvantages in its use for large marine work, the chief thing being lack of easily worked reversing power. A proposal for a set of 1,000 I. H. P. gas engines, designed for use on board ship, with a plant for producer gas, which got over the reversing difficulty, has not crystallized into actual practice, but it is one of the near possibilities. The advantage of this system is its great economy compared with either steam or the ordinary oil engine.

"The work of the Engineering Standards Committee has been continued during 1905, and two valuable reports have been made. Their list of standard rolled sections was published in March, 1903. During 1905 the committee issued a standard specification of structural steel for use in ship building, and a similar specification of steel for use in marine boilers. The former includes tests recommended for steel plates, angles, channels, bars and rivets used for ship building, together with sketches showing the forms of the standard tensile test pieces. The tensile test adopted is 28 to 32 tons per square inch which is that hitherto accepted by Lloyds committee, and is somewhat in advance of the 26 to 30 tons formerly required by the admiralty. It will be a great advantage to the steel manufacturers to have a uniform method of testing which all their customers requiring the best material will agree to accept. The committee are now considering specifications for steel castings and forgings, and standard tests for bar iron.

"The admiralty, both in their ship building and engineering departments, have continued their policy of standardization and interchangeability. In the hull specifications, a list is provided of fittings which are standardized, and contractors have to conform to standard sketches. This all makes for economy in the after life of a ship when fittings have to be renewed. Of course, these standard fittings have occasionally to be redesigned to meet new conditions. The greatest experiment in this direction has been that of designing exactly similar machinery for whole classes of ships and making all the parts interchangeable; and in this experiment the machinery contractors have cordially co-operated with the admiralty. Thus all the cruisers of the Duke of Edinburgh class and the battleships Lord Nelson and Agamemnon have interchangeable machinery. Further progress has been made in wireless telegraphy, submarine signaling, and in other directions during the year 1905."

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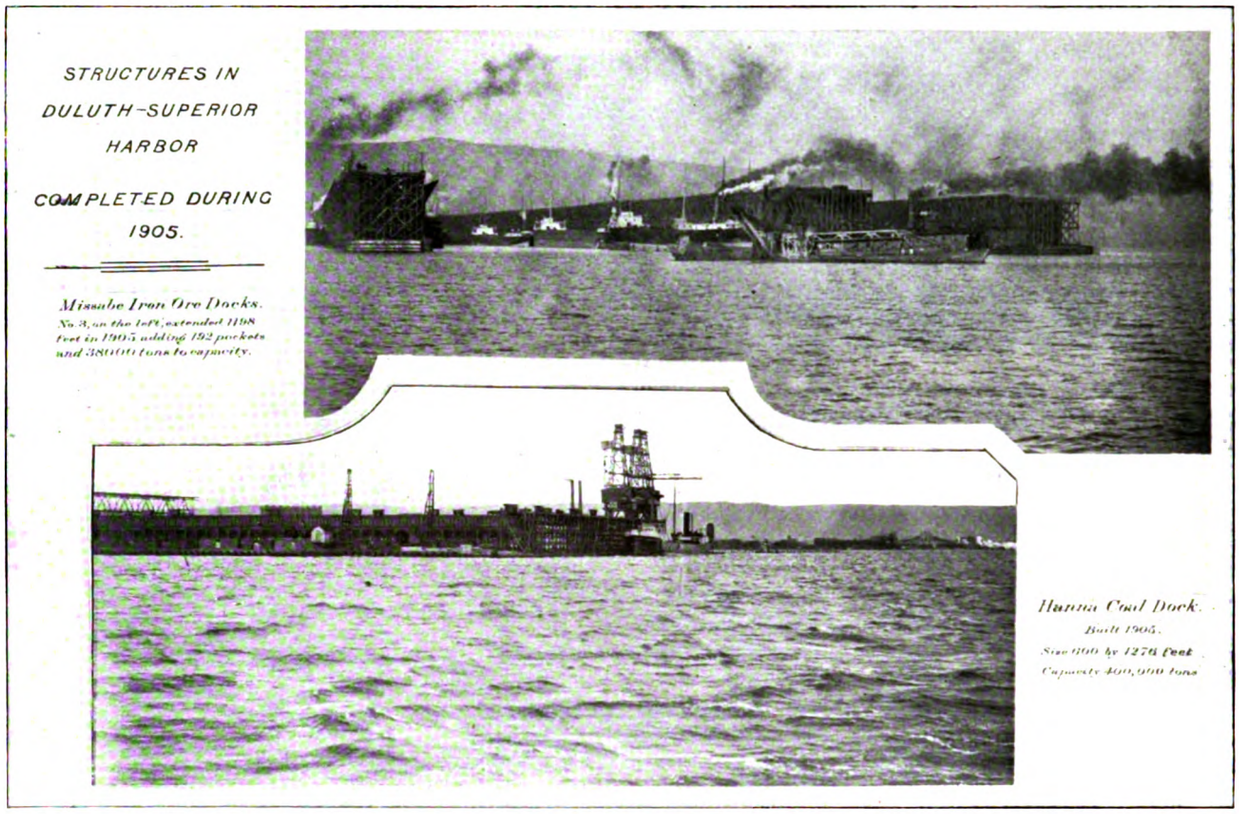
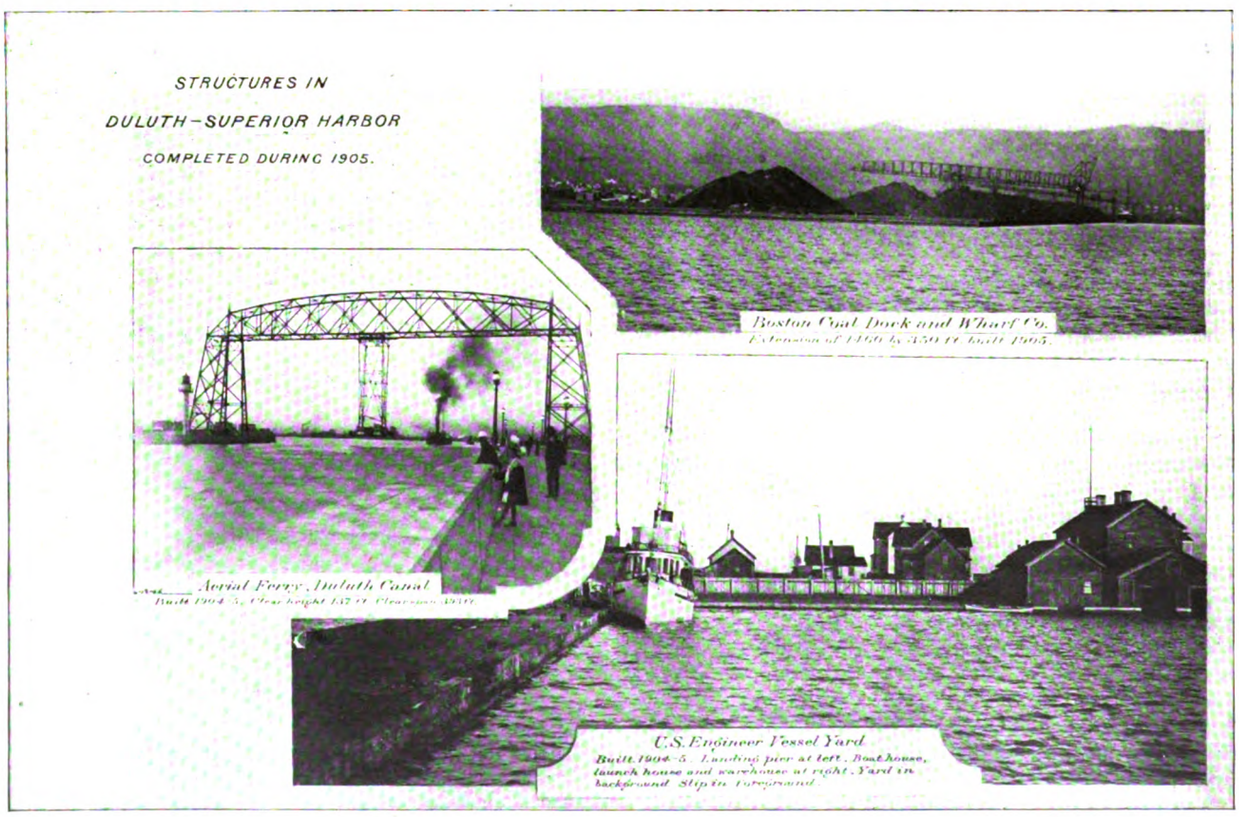


FROM MAJ. CHARLES L. POTTER'S REPORT.

COMMERCE OF DULUTH-SUPERIOR HARBOR.

The annual report of the lake commerce of the Duluth-Superior harbor for 1905 was recently compiled by Major Charles L. Potter, government engineer in charge of the district. The number of vessels entering and clearing was 13,549 and the freight carried by them 22,676,145 net tons, valued at $196,751,583. The increase in freight tonnage over 1890 was 696 per cent and over 1904 36.46 per cent.


STRUCTURES IN
DULUTH-SUPERIOR HARBOR
COMPLETED DURING 1905.
Boston Coal Dock and Wharf Co.
Aerial Ferry, Duluth Canal
U.S. Engineer Vessel Yard
Built 1904-5. Landing pier at left. Boat house, launch house and warehouse at right. Yard in background. Slip in foreground.

FROM MAJ. CHARLES L. POTTER'S REPORT.

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The navigation season for Duluth-Superior harbor aggregates only eight months per annum while at ocean ports navigation is carried on for twelve months. Considering the mean monthly freight movement during the season of navigation, Duluth-Superior harbor practically stands next to New York. The navigation season covered a third of 254 days, or from April 8 to Dec. 18. The following table gives a description, quantity and value of the commerce of Duluth-Superior harbor for the last year:

RECEIPTS AND SHIPMENTS WITH VALUATIONS FOR THE CALENDAR YEAR 1905—DULUTH AND SUPERIOR COMBINED.

Description of Cargo.	Unit.	Quantity.	Unit Price.	Valuation.
Barley, oats, rye, corn	Bushels	16,808,223	$0.46	$7,731,782
Cement	Barrels	240,885	1.40	337,239
Coal, hard	Tons	779,598	6.25	4,872,487
Coal, soft	"	2,827,957	3.65	10,322,043
Copper	"	19,771	320.00	6,326,720
Fish	"	1,282	75.00	96,150
Flaxseed	Bushels	16,280,817	1.24	20,188,213
Flour	Barrels	4,765,160	4.50	21,443,220
General Merchandise	Tons	219,258	165.00	36,177,570
Gravel	Cu. Yds.	34,275	1.00	34,275
Iron, manufactured	Tons	98,159	70.00	6,871,130
Iron ore	"	15,507,125	2.40	37,217,100
Lath	M.	26,030	3.25	84,598
Limestone	Tons	70,455	1.50	105,683
Logs, pine	M. Ft.	34,285	13.00	445,705
Lumber	"	416,211	16.00	6,659,376
Machinery	"	506	330.00	166,980
Oil	Barrels	133,388	6.75	900,369
Oil cake	Tons	10,030	27.00	270,810
Poles	No.	150,990	1.40	211,386
Salt	Barrels	396,366	.75	297,274
Sand	Cu. Yds.	24,444	.75	18,333
Shingles	M.	603,370	2.50	1,508,425
Stone, building	Tons	7,930	5.00	39,650
Ties, R. R.	No.	74,612	.42	31,337
Wheat	Bushels	27,733,263	.95	26,346,600
Miscellaneous items not included in above	Tons	7,925	1,000.00	7,925,000
Wool				122,128
Total valuation				196,751,583

COMMERCE OF PORTAGE LAKE SHIP CANAL.

The annual report of Major Charles L. Potter, of the commerce through the Portage Lake ship canal for 1905 shows that 3,757 vessels of all classes used the canal during the year. The freight transported through it aggregated 2,413,445 tons valued at $79,869,500. The increase in freight tonnage over 1895 is 222 per cent and over 1904, 7.72 per cent. The navigation season covered a period of 244 days extending from April 12 to Dec. 11. The average cargo through the canal is steadily increasing in size. In 1892 it was 1,607 tons, in 1895 2,325 tons, in 1897 3,024 tons, in 1900 4,406 tons, in 1903 6,300 tons and in 1905 9,400 tons. Loaded vessels 500 ft. in length drawing 19 ft. passed through the canals during the year without difficulty. The commerce on Lake Superior is heaviest during July and August, yet more freight went through this waterway during October and November, or in the stormy season, than at any other time, which shows clearly the extent to which these canals are used for refuge. The following table gives the description, quantity and value of the freight carried through the Portage Lake ship canals during 1905:

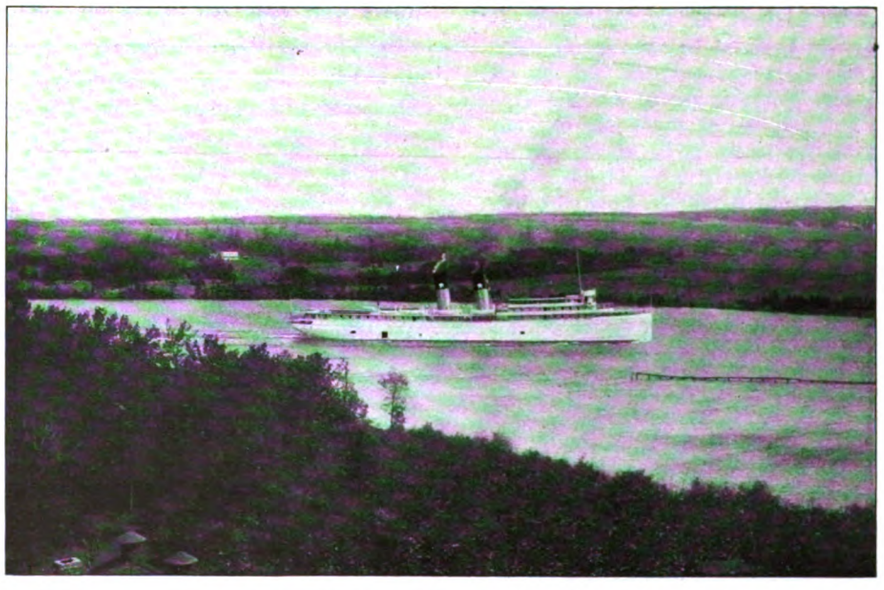
VALUE OF FREIGHT CARRIED THROUGH PORTAGE LAKE SHIP CANALS DURING THE CALENDAR YEAR 1905.

Description of Cargo.	Unit.	Quantity.	Unit Price.	Valuation.
Cement	Barrels	63,650	$1.40	$89,110
Coal, hard	Tons	162,872	6.25	1,017,950
Coal, soft	"	1,025,994	3.65	3,744,878
Copper	"	95,533	320.00	30,570,560
Flaxseed	Bushels	783,522	1.24	971,567
Flour	Barrels	719,329	4.50	3,236,980
Grains (except flax and wheat)	Bushels	751,584	.46	345,729
General Merchandise	Tons	176,706	165.00	29,156,490
Iron, manufactured	"	56,835	70.00	3,978,450
Iron ore	"	198,281	2.55	505,617
Lath	Thousand	3,038	3.25	9,874
Limestone	Tons	34,851	1.50	52,277
Lumber	M. Ft. B. M.	243,768	16.00	3,900,288
Oil	Barrels	36,181	6.75	244,222
Pig iron	Tons	10,984	16.25	178,490
Salt	Barrels	146,356	.75	109,767
Sand	Cu. Yds.	10,273	.75	7,705
Shingles	Thousand	60,910	2.50	152,275
Stone, building	Tons	8,651	5.00	43,255
Ties, R. R.	Number	51,549	.42	21,650
Wheat	Bushels	1,557,049	.95	1,479,197
Unclassified	Tons	6,960		53,169
Total valuation				79,869,500

In addition to the above, 9,893,000 ft. B. M. of logs, valued at $128,609, were towed through the canals.

The submarine torpedo boats Porpoise and Shark, which have just been thoroughly overhauled at the Brooklyn navy yard, were given an endurance run recently to test their efficiency. The Porpoise was commanded by Lieut. Charles C. Nelson, and the Shark by Lieut. Lloyd Shapley. They maintained an average speed of about 8½ knots throughout the run, with a choppy sea and the northwest wind blowing twenty-five miles an hour.

The ship yards at Jacksonville, Fla., are busy in the construction of steel barges. The Merrill-Stevens Engineering Co. built eleven steel barges for the Isthmian canal Commission. The Southern Ship Building Co. and the South Jacksonville Dry Dock Co. have also orders on their books for barges. The Southern Ship Building Co. is also building a four-masted schooner for the Cook-Cummer Steamship Co., of Philadelphia.



STEAMER PASSING THROUGH PORTAGE LAKE. *From Maj. Charles L. Potter's Report.*

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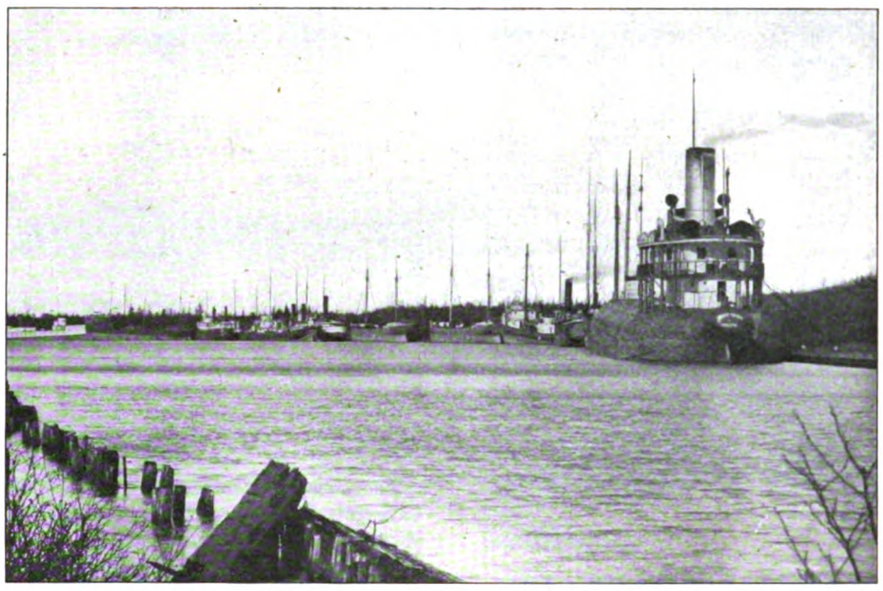
LLOYDS SHIP BUILDING RETURNS.

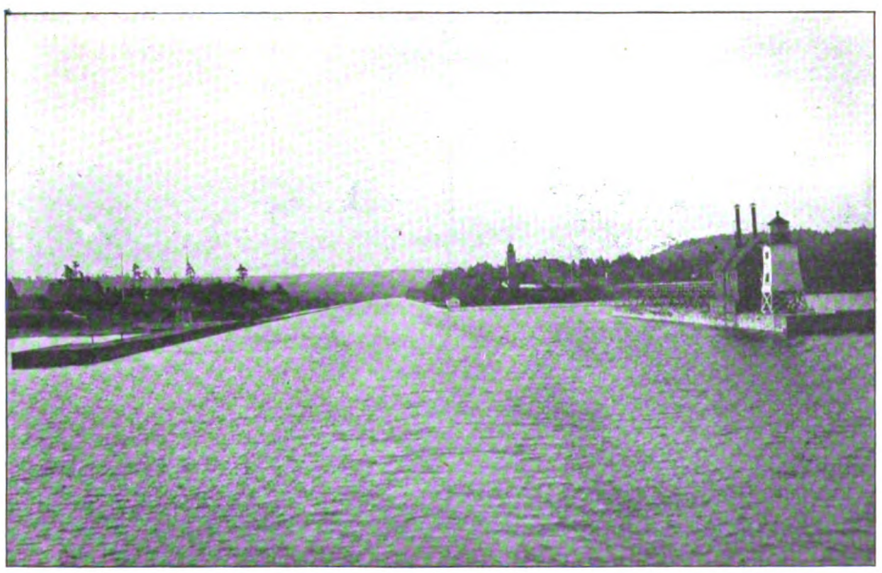
The most significant and interesting statement in Lloyds annual summary of ship building in the United Kingdom and abroad during 1905 is the statement that 99.9 per cent of the tonnage launched in the United Kingdom during the year has been built of steel and that 98.87 per cent was steam tonnage. During the year, exclusive of war ships, 795 vessels of 1,623,168 tons gross (737 steamers of 1,604,696 tons and 58 sailing vessels of 18,372 tons), were launched in the United Kingdom. The war ships launched at both government and private yards amounted to twenty-eight of 129,801 tons displacement. The total output of the United Kingdom for the year has therefore been 823 vessels of 1,752,969 tons. The output of mercantile tonnage in the United Kingdom during 1905 shows the great increase of 418,000 tons over that of 1904 and is the highest on record.

The wastage of vessels during the year was 238,000 tons of which 188,000 was steam and 50,000 sail. Other causes, such as sales, decreased the sailing tonnage of the United Kingdom by about 123,000 tons. There were numerous sales of steam tonnage also so that the net increase to the tonnage of the United Kingdom during the year was 469,000 tons. In 1905 21½ per cent of the total output was acquired by foreign and colonial ship owners, as compared with 18 2-3 per cent in 1904, 18 per cent in 1903 and 1902, 23 per cent in 1901 and 1900.

The returns continue to illustrate the tendency toward the construction of steamers of large tonnage. During the four years 1892-5 on an average eight vessels of 6,000 tons and upwards were launched per annum in the United Kingdom; in the following four years, 1896-99, the average rose to twenty-five and to thirty-nine for the four years 1900-3. Of vessels of 10,000 tons and upwards only three were launched in the four years 1892-5; seventeen were launched during the four years 1896-9; thirty-two were launched during the four years 1900-3. In 1904, however, the number of vessels launched of 6,000 tons and upwards was only fifteen, three of which were over 10,000 tons; but it again rose in 1905 to twenty-five vessels of which four were of 12,000 tons and over.



LILY POND—HARBOR OF REFUGE. *From Maj. Charles L. Potter's Report.*



INSIDE THE BREAKWATERS, LOOKING INTO UPPER CANAL. *From Maj. Charles L. Potter's Report.*

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profitable. That such methods have been used in connection with county work may be illustrated by the following: A contractor was the successful bidder for constructing a courthouse. The contract had a loophole—no foundation being especially mentioned, although the contract called for a complete building. As time for commencement had passed, the commissioners called on the contractor to commence work; he replied that work would be commenced as soon as the foundation was ready. To the surprise of the commissioners, they learned that the contractor was right—the contract provided for no foundation, although all other proposals received for the work showed that they apparently covered the cost of the foundation.

It is a grave mistake, however, to rely on changes in government contracts, as they require the approval of the higher officials before payment can be made, and the prices must therefore be reasonable.

Construction work connected with river and harbor improvements requires contractors to take big risks, especially if the work is to be done in a river or a harbor; and when this is necessary, due allowance should be made in bidding. This seems to have been overlooked by most contractors who have undertaken work in the Ohio valley, and the results have been most disastrous. Not only have contractors lost money, some having gone into bankruptcy, but the progress of the work has been unduly delayed.

With its sudden and numerous rises, the Ohio is a most troublesome river for those having construction work thereon. At best, there are not over five months in a year, which permit of profitably carrying on work in the Ohio river. Under such conditions, it is absolutely necessary to put in substantial preliminary work (cofferdams, etc.), especially if the work is to be carried over a winter, and completed within a reasonable length of time. Working in running water, especially in a river like the Ohio, requires experience, and those inexperienced would do well to avoid narrow margins in submitting proposals.

Perhaps nine-tenths of the delay in completing work on the Ohio river and the failure of most of the contractors to make a profit can be traced to the relying on a low-water season, and therefore constructing cofferdams which will not withstand an ordinary rise. There are known cases where contractors were compelled to pump out five times before being able to place permanent work. As it takes at least twenty-four hours to pump out, and perhaps as long again to remove the deposit and put matters in condition, this flooding of cofferdams proves costly. Building locks and dams is serious and costly work (a complete structure on the Ohio costs in the neighborhood of a million dollars), and it is doubtful if any man would undertake such work simply for recreation. Why, then, should men bid less than the work can actually be done for? Are they so anxious for work, or do they consider it an honor to do government work? There may have been a day for large profits made irregularly, but one needs only refer to the Greene and Gaynor case at Savannah to know that profits cannot be expected from such sources in the future.

No one is benefited by the failure of a contractor on government work, and it appears unreasonable that men should lose large sums of money while doing work for the United States—a government fully able to pay for the best and which should accept only the best. If contractors desire to do work at losing prices, let them give the benefit to our private citizens in moderate circumstances or to some of our struggling corporations (anti-trust).

There have been several failures among contractors who have accepted work on the Ohio river, caused by inexperience and low prices. It is only within the last three years that men of experience have undertaken the larger contracts, and the results are gratifying. They have shown what can be done. Men without experience in that class of work and without plant or capital who have attempted the building of locks and dams not only ruined themselves and their friends, but caused delay to important work and brought discredit to the men in charge.

DOCK MANAGERS' CONFERENCE.

The dock managers are holding conferences at present with the representatives of the International Longshoremen's Association regarding hours of labor and wage conditions on Lake Erie docks. Last season the ore handlers worked eleven hours a day up to Sept. 1 and ten hours during the balance of the season. The men are now asking for a ten-hour day and an increase in wages of 7½ per cent. With the volume of business to be handled the managers do not feel that the hours of labor can be shortened. If they are, the burden will fall upon the vessel owners who have to pay extra for all the ore that is unloaded after regular hours. The dock managers probably would not look unkindly upon a ten-hour day provided a double shift could be worked, that is, the docks kept in continual operation twenty hours out of every twenty-four. In this way the maximum efficiency could be got out of the unloading machines. It is expected that an agreement can be reached by the end of the week.

FREIGHT SITUATION.

Coal freights have been established at 30 cents to the head of the lakes and 40 cents to Milwaukee, which is the figure at which most of the business was transacted last year. A considerable amount of coal has been covered at this figure and will be moved as soon as the weather permits. The ice report shows that there is very little ice in the upper lakes and what there is is not of much thickness. From the present outlook it appears as though navigation would surely be opened by April 1. Those closest to the trade do not expect a coal miners' strike. No additional charters for ore are reported and it is now expected that a considerable volume will be moved wild.

The steamer John Sherwin, building at the West Bay City yard of the American Ship Building Co., will be launched on Saturday of this week.

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STEEL BARGES ON THE OHIO AND MISSISSIPPI RIVERS.*

BY RICHARD J. DONOVAN.

We may divide the business of river transportation into two general classes—first, that which pertains to bulk quantities, including such staple articles as coal, steel, grain, etc.; second, that which pertains to package quantities, including the general run of merchandise which may come in some form of package or in quantities which will not warrant special shipment. We find that in the case of the first class or bulk quantities the problem consists in simply loading the article considered in some type of carrier and delivering at some destined river port, without breaking or shifting individual cargoes. With the second class, package freight, there is more or less shifting or breaking cargo, with additions or subtractions at various points.

Of course the handling of bulk quantities is by far the more interesting problem to the engineer, and it is here that the observer is astonished a the magnitude of such individual movements on our rivers. The total navigable mileage of the Ohio and all its tributaries is about 4,400 miles, the Ohio itself being about 1,000 miles from Pittsburg to Cairo, where it empties into the Mississippi.

The gross freight movement on this vast waterway system amounts to about 11,000,000 tons per year, the coal from our Pittsburg district constituting about half of this tonnage. In handling this enormous business there are employed about 480 steamboats of all descriptions and some 6,000 or 7,000 barges. I might add that one company here in Pittsburg, the Monongahela River Consolidated Coal & Coke Co., owns upward of 100 tow boats of all descriptions, together with 3,000 barges, and ships annually about 4,000,000 tons of coal.

The various types of carriers used on this great system may be divided into two classes—first, those provided with their own propelling machinery, such as the stern and side wheel steamboats; second, all carriers that have to be towed or moved by external means, such as the coal barge or decked merchandise barge. We would here note that a large number of craft are used in maintaining traffic, such as dredges, snag boats, derrick boats, repair and pump boats, etc. The two general classes are the result of many years' experience and hard thought on the part of those engaged in the river business, and I may add that the types adopted are peculiarly fitted for the service.

CONSTRUCTION OF RIVER CARRIERS.

The final result in any design for a carrier on any waterway system is a compromise between adaptability for certain speed, draught of water available and carrying capacity required, there being, of course, many other details peculiar to the service conditions. The requirements for a river steamboat, then, may be briefly stated to be (taking first the case of the packet steamer) such speed as has been found economical for the service engaged in, the least possible load draught, and such freight and passenger capacity as the usual run of business would warrant. In the case of the tow boat large reserve propelling power is an important item, and, due to the fact that coal barges leak more or less, there must be a large excess in boiler capacity for the purpose of operating the steam siphons which are used to keep the tow clear. The under water parts of the tow boat hull are as a rule not so fine as a packet boat—that is, they are not formed for such speed. They are not intended to carry cargo and the accommodations provided are generally but little in excess of those required by the crew. The boats are well supplied with all kinds of appliances and machinery for handling the tows and in the intricate and shallow channels are admirably suited for the purpose intended.

In bulk transportation we have seen that coal is far in the lead as a staple product. The carriers used in this trade are divided by the river men into two classes, known respectively as the barge and the boat, both of which are rectangular in plan and resemble large open boxes. The ends of both are usually curved or raked from the bottom to the head blocks, as the ends which take the bumps and shocks are called. Bulkheads are fitted in some at each end, separating the rake end from the main cargo space. In passing I would state that the barge is much used in the Cincinnati and Louisville trade, while the boat is employed almost exclusively in the Mississippi river business. The barge is usually about 135 x 26 x 8 ft., and will carry between 15,000 and 16,000 bus. or nearly 600 tons on a draught of about 6 ft. 6 in. The boat is usually about 170 x 28 x 8 ft. 6 in. and will carry about 25,000 bus. or 950 tons. The barge is built in a very substantial manner and will last for some time, but the boat is merely thrown together and can stand but little hard usage. For some kinds of cargoes, such as sand and bulk merchandise, deck barges are used. These are of various dimensions and built to stand the hardest usage.

There is also a very important business on the Mississippi river in the transfer of railroad cars from side to side. These car ferries or transfer boats are generally of large dimensions and are supplied with their own power. There is also in use a number of transfer barges, built in the most substantial manner especially for this business.

Up to the present time wood has held its own in river construction on account of its cheapness, for the wooden structure costs but one-half to one-third as much as the steel structure. However, suitable timber is becoming very costly on account of its scarcity, and the large operators are beginning to investigate the relative advantage of steel for their transport fleets. At present there are several examples in steel of the various types discussed operating on the Ohio river, and experience has shown that the steel hull is far superior to the wooden hull in cost of upkeep, while its life it double that of the wooden.

THE TYPICAL STEEL RIVER BOAT.

We will now examine the construction of a typical steel river steamboat. The general principle involved in the construction of any type of boat is usually embodied in arranging a longitudinal "backbone" consisting of longitudinal bulkheads, keelsons and stringers. At right angles to the backbone is arranged a system of ribs or tranverse members, consisting of floors, side frames, deck beams and cross bulkheads. The shell or outside plating is then riveted to the skeleton frame. The bulkheads and shell plating are fitted watertight, this being accomplished by proper spacing of rivets and judicious use of caulking tools. Some very interesting construction is required to insure water tightness, but as a rule in shallow draught river crafts the water pressure is so low that it is not at all difficult to solve the problem. A complete or partial steel deck is usually provided and on this steel foundation the wooden cabin and upper works are built.

There is also usually provided a "hog chain system" to insure longitudinal strength. This is a truss arrangement consisting of a square or round section rod carried over tube or timber bracing and leading from the bow of the boat to the stern. It usually projects above the cabins and is quite apparent. The aim is to make the structure as light as possible consistent with the required stiffness and strength for the service conditions.

It is perfectly feasible to make an analytical study of the structure of a boat, but in river work such an investiga-

*From a paper read before the Engineers' Society of Western Pennsylvania, Pittsburg, Pa.

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tion, using the sizes and sections fitted in the best work of this kind, would show a most amazing confidence in steel and would probably deter the exact scientific engineer from competing in this line of work. The tow boat hulls are made much stronger than the packet boat hulls, since they have to stand much harder usage in every way, besides carrying much heavier machinery.

Now let us consider a steel open boat or barge for the transportation of coal. The same principle is carried out here as in the case of the steamboat hull—viz.: the "backbone" and "rib" construction. But here we have to depend more on the sides of the boat or barge acting as the backbone or longitudinal girders, for the interior or hold space must be available for cargo. The ends are usually curved up to heavy end construction known as the head block, which takes the bumping and blows incidental to the rough service. This curved part is called rake by river men and is introduced to ease the passage of the boat through the water. At the foot of the rake at each end a watertight cross bulkhead is usually used for safety purposes. The framing of the rake must be of a very substantial character, as it is here that the barge suffers most. The cross frames or ribs are spaced about 2 feet apart in the cargo space and at certain intervals there are beams fitted across the barge to stiffen the sides. The barge is merely a shell and of course some judgment must be used in unloading or loading the cargo in order to place no undue stress on the structure.

A type of steel coal barge of which a number have been built and are now in use has the steel plating all about ¼ inch in thickness, and the cross framing or ribs consists of channels and angles fitted alternately, except the side frames, which are angles. A steel watertight bulkhead is fitted at each end of the cargo space and a steel handling deck is arranged from top end of bulkhead to head block. A heavy channel is fitted at top to the side plating for lateral stiffness, and strong beams are fitted across the open cargo space at the quarter block or hawser posts. As the clamshell or unloading bucket is used in taking out the coal a wood flooring or ceiling is laid on the channel floor beams, thus presenting a smooth surface for the unloader. These barges have given good satisfaction to the owners and are said to hold about 80 tons more coal than the wooden barge of the same dimensions and draught.

In the construction of steel deck barges care must be taken to make the internal framing sufficiently strong to care for the general longitudinal stresses and also for those that are local. The conditions of service met with in dredge hulls are such that usually the local loading and stresses are very high, so that we have to deal not so much with general as with local stiffening; but the general construction of such hulls is identical in principle with that which we have already discussed.

MAINTENANCE OF STEEL BARGES.

In the matter of upkeep the preservation of steel plating and framing from oxidization is of the highest importance, and it is here that a great deal of trouble and expense is incurred. Due to there being so many manufacturing plants established on the banks of the rivers forming the Ohio large quantities of acid matter are drained into the water, giving rise to conditions which are highly injurious to the life of the steel river craft. The use of some good protective paint or covering is imperative, but such a paint is hard to find. There are, however, some such coverings which seem to hold in check this acid to a marked degree.

At present the business of transportation on the Ohio river is a speculation, depending entirely on the stage of water. The government is working to improve this state of affairs by a series of locks and dams along the whole length of the river. In time it is hoped that an 8 or 9 foot stage of water will be available the whole year, but it is said that this work will cost nearly $100,000,000 and will require about 100 years for completion. In the old days before the civil war the Mississippi and Ohio rivers were crowded with packets and freighters, and an enormous river business was carried on, but the railroads have now taken over the most of this traffic and the rivers are lined with the decaying remains of this once vast fleet.

OUR HANDICAP ON THE SEAS.

Just at this juncture it is well to draw the attention of congress to the fact that British ship building in 1905, was a record breaker, and that, therefore, more and more American goods, produced and bought, will be carried in British ships. This is unavoidable, to our heavy loss in freight moneys, while American ship building for foreign trade, is refused the protection afforded to other American industries, of no greater importance.

Note the largely increased tonnage built in British yards in 1905, compared with 1904:

	1905.		Increase over 1904.
	Vessels.	Tonnage.	Tonnage.
English yards	793	1,073,309	253,827
Scotch yards	412	587,932	125,792
Irish yards	42	149,427	91,877
Totals	1,247	1,810,668	471,496

Here is a production in a single year by British yards of more than twice the tonnage of our ocean-going marine, with an increase over 1904 production of more than half that tonnage.

In addition, the British colonies turned out 10,800 tons of new shipping in 1905, making in all, 1,821,468 tons for the British Empire.

The following table shows the shares of the principal ship building countries in the world's output of new ship tonnage of 3,000,000 tons in 1905:

British Empire.....	1,821,468
Germany	312,400
France	101,073

Against this large production, almost all for oversea work, all we have to offer in new tonnage is 368,800 tons, and that was nearly all for use on the great lakes. The world's increased ship construction in 1905 was 447,000 tons, but we only shared in it, counting all ships we built, irrespective of purpose, to the extent of 43,625 tons.

Great Britain also had, December 31, many more vessels under construction, of which 500,000 tons has been partly launched since January 1, and all of which will be fully launched early this year.

It is because of the activity in British ship building above noted, that the *London Times* is pleased at being able to say, "The American market has been good, with an active demand for tonnage at freight which compare handsomely with some past records. Undoubtedly the American market has been the great redeeming feature of most of the past year." That's just it. American trade, without American ships is a "redeeming feature" year after year, for every ship-owning country in the world.

The Liverpool ship, Glenelvon, has just completed a highly creditable performance in making the passage from Yokohama (Japan) to Los Angeles (California) in the remarkably short time of 26 days. She left the Japanese port on Dec. 14, under the command of Capt. E. E. Robbins, and arrived at the American port on the 9th inst., and as the distance between the two ports is approximately about 5,000 miles, the Glenelvon would average about 200 miles a day. This may not be the record passage for this particular route, but it is one of the fastest that has been made for some time past. The Glenelvon is a Port Glasgow built ship, and is owned by Messrs. G. M. Steeves & Co., of Liverpool.

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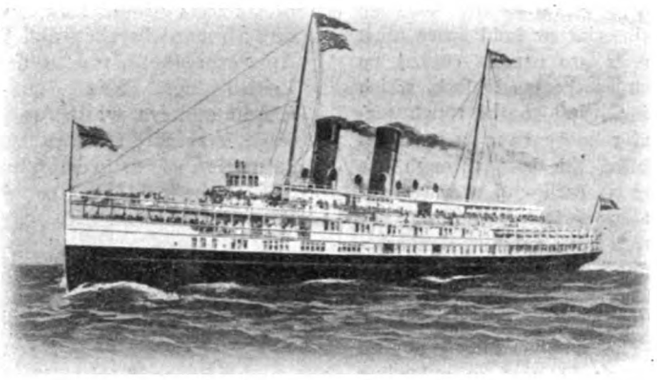
Launch of the Steamer Cayuga.

In a heavy rainstorm, succeeding a sleet storm of the early morning, and a strong blow from the southeast, the new steamer for the Niagara Navigation Co., was launched from the Toronto yard of the Canadian Ship Building Co. This is the first vessel launched from this yard since it was taken over from the Bertram Engine Works Co., and is the first vessel built by the Canadian Ship Building Co. The launch was timed to take place at noon, and precisely at that hour the last blocks were removed, Miss Mary Osler, daughter of E. B. Osler, M. P., president of the Niagara Navigation Co., broke the traditional bottle of champagne on the bow, pronouncing the words "I christen thee Cayuga," and the hull slowly gathering way glided off the ways, and dropped gracefully into the water. The momentum carried her across to the adjoining dock where she was brought up and moored.



THE CAYUGA AS SHE WILL APPEAR WHEN COMPLETED.

Following the launch there was a luncheon at the King Edward hotel at which there were about 120 guests present representing the financial, commercial, municipal and transportation interests of Toronto. F. Nicholls, president of the Canadian Ship Building Co., occupied the chair, and those present included E. B. Osler, M. P., president Niagara Navigation Co.; the mayor of Toronto; A. Angstrom, general manager, Canadian Ship Building Co.; B. W. Folger, general manager Niagara Navigation Co.; H. J. Prince, president International Traction Co., Buffalo, N. Y.; Senator J. K. Kerr; Colonel Hughes, M. P.; F. Barlow Cumberland, vice president Niagara Navigation Co.; H. Foster Chaffee, Richelieu & Ontario Navigation Co., Toronto.

After lunch the chairman on behalf of the ship building company expressed the pleasure he had taking part in the day's proceedings and complimented the Niagara Navigation Co. on the enterprise it had shown in deciding to construct such a steamer and in placing the order in Toronto. Its other steamers, the Corona and Chippawa, both of which were built in Toronto, had been designed in advance of the requirements of the traffic, but the company's foresight had in each case been amply justified. It was the hope and belief of all that a similar result would follow that advent of the Cayuga. The mayor of Toronto briefly proposed prosperity to the Niagara Navigation Co., congratulating the city on possessing a company sufficiently enterprising to order, and another company capable of building such a steamer. E. B. Osler, replying referred to the enterprise of the late Sir Frank Smith and the late F. W. Cumberland in establishing the line, and to the grave consideration given in 1895 to the question of placing an order in Toronto for the new vessel then contemplated. The confidence then placed in the firm with which Mr. Angstrom was then connected, and of which the Canadian Ship Building Co. was the successor was amply justified and the Chippawa succeeded the Corona in due course. These successes it was to be hoped would be followed by the Cayuga. D. R. Wilkie, general manager Imperial Bank, proposed success to the Canadian Ship Building Co., to which Mr. Nicholls and Mr. Angstrom replied. In proposing the toast of Miss Mary Osler, who named the new steamer, B. W. Cumberland referred to the appropriateness of the names of the company's steamers. The first was the Chicora,—the pretty flower—named from the Indian territory of and around Florida; followed by the Cibolo. This steamer was burned and was replaced by the Corona, after the bright ring seen when the moon is in eclipse—an appropriate name under the circumstances. This was followed by the Chippawa, another Indian name, and now they had added the Cayuga, after one of the five nations associated with the country surrounding Lake Ontario. Our Canadian allies was proposed by Mr. H. J. Pearce, Buffalo; and the health of Mr. B. W. Folger was proposed by Mr. Nicholls. The latter in reply pointed out that a year ago the Canadian Ship Building Co. was but a name; today it had on its books orders for six large steamers, which would keep a large number of men busy for some months to come. The industry was an important one for the country as it was for the city.

The Cayuga is a departure in many respects from the other steamers of the Niagara Navigation Co., the most important being that she will be propelled by twin screws instead of paddle wheels. The general outlines of the other steamers are followed as far as possible; and the internal arrangements are planned on the most modern lines to afford the greatest accommodation and conveniences for the passengers. Her dimensions are: Length, 317 ft. 6 in. over all; beam of hull, 36 ft. 6 in.; over guards, 51 ft. 8 in.; depth, 15 ft. molded; draught, 10 ft. The hull is of steel and is divided into eight water-tight compartments by seven bulkheads; thus rendering her practically unsinkable. She will be driven by twin screws, power being supplied by two sets of engines, of the vertical inverted, direct-acting, quadruple expansion type, balanced on the Yarrow, Schlick & Tweedy system, having cylinders, 17½ in., 25 in., 36 in. and 52 in. diameter by 30-in. stroke. Steam will be supplied by seven Scotch marine boilers 11 ft. diameter by 12 ft. fitted with two corrugated furnaces. The Howden heated draft will be used. The engines are designed to develop 4,300 H. P., which is about 30 per cent in excess of the Richelieu & Ontario Navigation Co.'s steamer Montreal, at present the largest and most powerful passenger steamer navigating Canadian waters, and is exceeded by very few vessels on the United States side of the great lakes.

The vessel is planned on the lines of the day service observation type of steamers, having four principal decks, namely: main deck, promenade deck, upper promenade deck, and lower or orlop deck below the main deck. There will be three gangways on each side, the forward ones for passengers and express, the middle ones for passengers' baggage and the aft one for passengers only. This latter will lead directly into the entrance hall on the main deck, where will be found the purser's office, a parcel checking room and other offices with which passengers have to come

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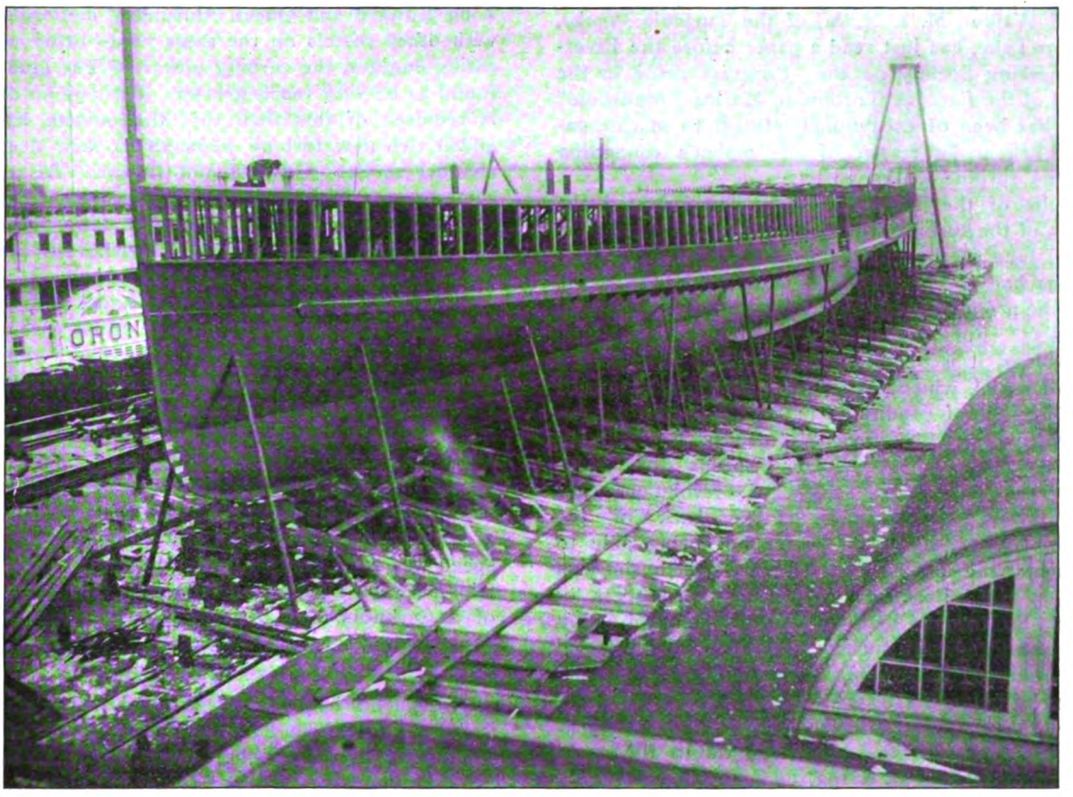

PHOTOGRAPH OF THE CAYUGA TAKEN A WEEK OR SO BEFORE LAUNCHING.

in contact. Here also will be the ladies' retiring room, which will be specially fitted for the comfort and convenience of ladies, and will include a number of new features. There will be a staircase 7 ft. wide to connect the entrance hall with the promenade deck above. The dining room will be on the main deck, and will be fitted with large observation windows on each side, so that an uninterrupted view may be had. It will have a seating capacity of 150. The main deck will be of steel covered with wood, and interlocked rubber tiling will be used as a flooring in several parts of the vessel devoted to passenger accommodation. On the promenade deck the principal feature will be the general saloon, which will extend the full width of the steamer. It will be a particularly handsome apartment, and the sides, instead of being straight, will consist of a series of bow windows, so that views may be had ahead and astern as well as straight out. At each bay seats will be provided so that small parties may keep together. Two of the bays will be finished as private parlors, which will be available for letting to parties who desire to be alone. The upper promenade deck, which will be reached by a stairway from the general saloon, as well as by stairways from outside on the promenade deck, will extend over the whole vessel, instead of ending just forward of the wheelhouse as in most vessels of this type. The rail will be inside the lifeboats, and the entire width of the deck will be available for passengers. The captain's quarters, the wheelhouse, and the pilot's room will be on this deck. A light shade deck amidships will give shelter over this deck. The space over the engine room, instead of being closed in with steel plates, will be surrounded with a framework in which plate glass sides will be fixed so as to enable passengers to have a view of the machinery. On the lower or orlop deck will be found the crews' quarters, kitchens, smoking room, engines and boilers, etc. In working out the details there may be some slight changes from these arrangements but nothing material. The whole of the interior has been planned so as to provide the greatest accommodation for the passengers, and for the convenience of the crew in working the steamer.

The decorations will be particularly striking. The entrance hall will have a heavy beam ceiling; the main stairway will be in cathedral oak; the dining room in mahogany, and other portions of the passenger accommodation in weathered and quartered oak. The designs show some very fine effects and will present a rich and artistic appearance. The furnishings of the various rooms will be in harmony with the general decorative design and color scheme.

The steamer is expected to be completed for the opening of the current year's traffic, and it is hoped to have her running on June 15, when a full service of six trips a day will be given. The steamers to be put on the run will be the Cayuga, Chippawa and Corona. The Chicora will probably be used as a spare steamer, or put on some other route.

BIDS FOR REVENUE CUTTER NO. 15.

Bids for the construction of revenue cutter No. 15, described in the March engineers' issue of the MARINE REVIEW, were opened on Saturday, March 3 with the following results:

BATH IRON WORKS, BATH ME.

For the vessel in accordance with specifications.....$199,000

MARYLAND STEEL CO., SPARROW'S POINT, MD.

For the vessel in accordance with specifications...$219,000
With electric light plant omitted.....$212,000

THE PUSEY & JONES CO., WILMINGTON, DEL.

For the vessel complete.....$174,900
With electric light plant omitted.....$167,750

The contract will undoubtedly be awarded to the Pusey & Jones Co. on their bid of $167,750.

The Great Lakes Towing Co. is preparing plans for an ice crushing tug similar to the wrecker now in service at Duluth. It will be built at the company's yard in Chicago.

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AN EXPERT ON TURBINES.

Mr. R. J. Walker, M. I. N. A., of the Turbinia Works, Wallsend-on-Tyne, has just read a paper before the Liverpool Engineering Society on the "Progress made in the Application of the Parsons' Turbine to Marine Propulsion." The paper has been of exceptional interest to marine engineers in Britain by reason of the author's connection with Parsons' turbine works.

The results of the Turbinia clearly demonstrated the possibilities of the turbine when applied to the propulsion of vessels. One of the chief difficulties, however, which Mr. Parsons had to contend with in applying the steam turbine to the propulsion of ships, arose in connection with the propellers. For reasons of economy in steam, and size of turbines, it is necessary for turbines to run at a high rate of speed, which necessitates the introduction of some modification of conditions in regard to the propellers as compared with propellers driven by ordinary reciprocating engines at slower speeds of revolutions. When very high rates of revolutions are adopted, cavities are formed at the back of the propeller blades, owing to the water not being able to follow around the blades fast enough, which detracts largely from the efficiency. Following the success of the Turbinia the torpedo boat destroyers Viper and Cobra were built and fitted with turbine machinery for the royal navy, and achieved remarkable speeds, the Viper taking the position of being the fastest vessel in the world, having attained the phenomenal speed of 36.86 knots per hour. Unfortunately, however, the Viper ran on to the rocks of the Channel Islands in a fog, and ultimately became a total wreck. The Cobra foundered in a storm. Thus, after two or three years of hard work, the Turbinia was the only vessel afloat fitted with turbine engines. The Parsons Marine Steam Turbine Co. had directed their almost exclusive attention to the introduction of the turbine in destroyers, as being the most favorable among vessels for the application of the turbine system, but, unfortunately, owing to a report prevalent at the time that the consumption at cruising speeds was much greater than that of ordinary engines, and by the total loss of the only two sets of machinery fitted at that period, with the exception of the Turbinia, it had a very detrimental effect upon the introduction of turbine machinery generally.

About this period very great difficulty was experienced in endeavoring to induce railway companies, and owners of mercantile vessels to build a turbine vessel; each company appeared to be very anxious that someone else should make the first experiment. Those closely associated with the development of the turbine were beginning to somewhat despair of success when Captain John Williamson came forward, and the result ot a conference between Messrs. Denny and Bros., of Dumbarton, Captain Williamson, and Mr. Parsons, was that it was resolved to build a turbine vessel for passenger service on the Clyde. It was in the year 1901 that the King Edward, the first turbine vessel for the mercantile marine, was built. So successful was this vessel during the first season's running on the Clyde (the year of the great exhibition at Glasgow), that an order was placed for a second vessel, Queen Alexandra, and the performance of these two vessels running on the Firth of Clyde, demonstrated the commercial advantages accruing from the adoption of the turbine system. Captain Williamson's name will long be associated as the pioneer ship owner adopting the turbine system for the mercantile marine.

CHANNEL STEAMERS.

The first vessel to be fitted with turbines for cross-channel service was The Queen, for the South Eastern & Chatham Railway Co.'s Dover and Calais route. This vessel confirmed the economical results obtained in the King Edward and Queen Alexandra, and when compared with other vessels on the same route fitted with reciprocating engines, the earning power of The Queen has been found to be very much greater. Perhaps no clearer proof is required of this than that the owners have recently added two new turbine steamers to their fleet for cross-channel service—Onward and Invicta. At or about the same time as The Queen was ordered the London, Brighton, and South Coast Railway Company placed an order for a channel steamer for their Newhaven-Dieppe service, viz.: Brighton, and they last year added a second turbine vessel—Dieppe—to their cross-channel service. One of the latest channel steamers to be fitted with turbine machinery is the Viking. She was built and engined on the Tyne for the Isle of Man Steampacket Company, for their Liverpool to Douglas service. This vessel achieved the mean speed of 23.53 knots on her official trial from Souter Point to Flamboro' Head and back. An abstract from the log of this vessel on her first season's running, last year, shows that during the months of June and July she made 31 trips between Liverpool and Douglas, and her average speed was 22.22 knots. In the month of July she made 15 trips between Douglas and Fleetwood at an average speed of 22.67 knots, and between Douglas and Dublin three trips, average speed 22.39 knots.

TURBINE YACHTS.

Five yachts have now been fitted with Parsons' marine turbines, viz.:—The Emerald, to the order of Sir Christopher Furness, M. P.; the Lorena, for A. L. Barber, Esq.; the Tarantula, for the late Colonel M'Calmont; the Narcissus, for E. M. Mundy, Esq., and the Albion, for Sir George Newnes. The two latest yachts fitted with the Parsons' turbines are the Narcissus, built and engined by the Fairfield Shipbuilding Company, and the Albion, designed by Sir W. H. White, built by Messrs. Swan, Hunter and Wigham Richardson, and engined by the Parsons' Marine Steam Turbine Company. The propelling machinery of both of these yachts, it is understood, have given every satisfaction since they were handed over to their respective owners. By the courtesy of Mr. Gracie, of the Fairfield Shipbuilding Company, the author is able to give a comparison of the coal consumption of the turbine with reciprocating engines, based on results obtained from s.y. Narcissus and triple-expansion engines in a Clyde-owned yacht of about the same H. P., from which it will be noted that at full power the turbine boat has a slight advantage; at three-fourths power they are equal, whilst down as low as 30 per cent of the full power the falling off in economy of the turbine is not at all serious. In yachts where a great deal of cruising is required below one-third to one-half power, cruising turbines could be fitted, if required, to assist the economy at the lower speeds.

ALLAN LINE ENTERPRISE.

The Allan Line Steamship Company were the first to introduce the turbine system to vessels of large size and moderate speed for Atlantic work, and the two vessels fitted, viz., the Victorian and the Virginian, gave very satisfactory results on trial trip on a reduced draft. It is understood they have done very good work whilst on service on the Liverpool-Canadian route during the season 1905, and have become very popular with passengers. The best mean speed over the passage between the two points of call has reached 17.2 knots per hour with an estimated i.h.p. of 12,600, and the coal consumption worked out about 1¼ pounds per estimated I. H. P. for all purposes.

WAR VESSELS.

As regards war vessels, the destroyers Velox and Eden were the next vessels following on the Viper to be built

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for the British admiralty. These two vessels were fitted with additional engines for obtaining economical results when cruising at low speeds. The Velox was fitted with two small auxiliary reciprocating engines, whereas the Eden was fitted with two cruising turbines. When cruising at low speeds, the steam from the boiler passes through the two cruising engines in the case of the Velox, and the two turbines in series in the case of the Eden, and thence to the main turbines and condensers. An efficient expansion of the steam is thus secured from the boiler to the condenser pressure. The latest vessel to be fitted with turbines for the British admiralty was H. M. third-class cruiser Amethyst. This vessel is also fitted with cruising turbines, and the results of the trials, give the comparative performances of the turbine machinery as compared with sister vessels ordered at the same time as the Amethyst, and of the same dimensions and lines, but fitted with reciprocating engines. The trials of these ships unmistakably demonstrated the economy of the Parsons' marine turbine as fitted in this class of vessel, and more especially at the higher power.

THE GREAT CUNARDERS.

One of the greatest steps in the application of the turbine to marine propulsion was, undoubtedly, when the Cunard Steamship Company, after thorough investigation into the technical details and capabilities of the turbine by a committee of leading engineering experts, decided to adopt turbine machinery for their two new express liners, designed to be the largest, fastest, and most powerful vessels afloat. The author well remembers when Mr. Parsons, in one of the earlier papers, delivered before one of the leading technical associations, previous to the King Edward being tried, suggested that the proposal to fit Atlantic liners with turbines of 20,000 to 30,000 I. H. P. presented no great difficulties. The majority of engineers, who were imbued with the idea that what Mr. Parsons was attempting was impossible, were rather startled, and yet, within the period of four years since the first mercantile vessel was built, the turbines for the express Cunarders are under construction, each of more than double the horsepower mentioned by Mr. Parsons in the paper referred to. At the same time as it was arranged to fit the two express Cunarders with Parsons' turbines it was decided to fit one of the two intermediate Cunard liners, viz., the Carmania, then on order with Messrs. John Brown and Co., Clydebank, with turbines, thus forming a direct comparison with the sister vessel, the Caronia, fitted with reciprocating engines, and the results of the trials, which have appeared in *Engineering* and other leading papers, showed that the Carmania obtained a mean speed of 20.2 knots per hour, which was estimated to be about one knot faster than the Caronia, under similar conditions, and on service, the coal consumption on her first voyage has been reported to compare favorably with the very satisfactory performance of the Caronia in this respect.

THE PROPELLER PROBLEM.

It may be of interest, at this stage, to mention a few points incidental to the application of the turbine system to different classes of vessels. It is desirable, for obvious reasons, that a turbine for a given efficiency should be designed to run at as high a rate of revolutions as possible, consistent with propeller efficiency. The speed of turbines for land purposes is considerably higher than is permissible for turbines for marine purposes where the speed of rotation is limited by considerations of propeller efficiency. As already referred to, the great difficulty which Mr. Parsons had to contend with arose in connection with the number of propellers to adopt to obtain the best compromise of turbine and propeller efficiency. In the Turbinia, and in several of the earlier vessels, a considerable number of experiments were carried out with various designs of propellers. With the original engine that was tried in the Turbinia, nine propellers in all were tested, with the same unsatisfactory result. After the original turbine was removed and replaced by the existing three turbines, further propeller experiments were carried out. The first set tried consisted of three propellers on each shaft—nine in all—of 18 inches diameter and 18 inches pitch, which gave favorable results. Subsequently other sets were tried, and the set eventually adopted comprised three propellers on each shaft—nine in all—of 18 inches diameter and 24 inches pitch, so that dividing the power over the three shafts, a considerable increase in efficiency was obtained, and a speed of 32 knots was reached. In May, of 1902, further experiments were made with single propellers on each shaft. Progressive runs were first made with the nine propellers, when it was found that the speed relative to water consumption followed exactly the same curve as that obtained by Professor Ewing previously. The first set of single propellers tried were 28 inches diameter and 28 inches pitch, and the second set were of the same diameter, but with a pitch ratio of .8. The loss of efficiency which has been observed in some of the earlier vessels which were fitted with multiple propellers appears to have been due partly to the interference from the forward screws and partly to cavitation. There is no doubt that for certain classes of vessels the turbine has a distinct advantage over the reciprocating engine, and the larger the power of the machinery and the higher the speed of the vessel, the more favorable is the comparison with turbines as regards economy. There is, however, at the present time, a lower limit of speed of vessel below which this advantage gradually disappears, and this speed would appear to be, generally speaking, about 15 knots, with a corresponding horsepower of about 1,600. With higher powers (say) 5,000 to 6,000, then probably a lower speed of (say) 14 knots might compare favorably with reciprocating engines. For lower speeds of vessel, to obtain reasonable propeller efficiency, a certain diameter of propeller is necessary, and the revolutions to correspond are moderately low, and as it is necessary to obtain a certain surface speed of turbine, as well as a certain number of rows of turbine blades, to obtain reasonable economy, the size of the turbine becomes great in proportion to the power, the efficiency being somewhat impaired thereby; moreover, the weight and cost is increased as compared with turbine machinery of similar powers for higher speeds of vessel.

PARSONS' TURBINES' PECULARITIES.

In regard to the arrangement of turbines, this partly depends upon the condition of service, and the various classes of vessels require, more or less, to be taken upon their own merits. The arrangement which has been almost universally adopted in the mercantile marine is that of dividing the power equally over three shafts, viz., a high pressure on the center shaft, exhausting into two low-pressure turbines one on each side of the vessel. In such a case the high-pressure turbine is made suitable for an expansion ratio of about five, and the low pressure for 25. No doubt the members of this institution are more or less conversant with the principle of the Parsons turbine. Each turbine consists of a number of rings of blades or vanes mounted on a drum or rotor. This rotor is enclosed within a cylindrical case, upon which rings of blades are also fitted. The rings of blades are alternately fixed and moving, that is to say, the blades in the cylinder

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are stationary or guide blades, whilst the blades fitted on the drum are moving blades.

The diameter of the drum is less than the cylindrical case, and thus an annulus is left between the two, which is occupied by the blades referred to. Steam issuing from the boilers flows through the first row of fixed or guide blades on the cylinder; it then, in jets of moderate velocity, impinges on the moving blades, and imparts to them a rotary motion, this process being repeated on each successive ring of fixed and moving blades throughout the turbine. The areas of the steam passages through the blades gradually increase from one end of the turbine to the other, to correspond with the expansion in volume of the steam for the range of pressures from beginning to the end of the turbine. In the exhaust casing of each of the low-pressure turbines a reversing turbine is fitted. By means of suitable valves, when maneuvering, the low pressure and astern on each side of the vessel are capable of being worked ahead or astern, as required, independently of the high-pressure turbine (the high-pressure turbine under such conditions running idly in a vacuum.) By this arrangement the vessel has all the maneuvering qualities of a twin-screw vessel. In torpedo boats a similar arrangement is adopted as in the Turbina, viz., three in series, with one astern on the center shaft only. This arrangement permits of a reduced weight being obtained, as compared with the high-pressure and two low pressure in parallel for equal efficiency. In very large powers it is desirable to divide the power over four shafts, thereby increasing the revolutions and reducing the size of the units. The four-shaft arrangement lends itself well to large war vessels, as two complete sets of engines are obtained, viz., one high-pressure and one low-pressure, with condensing plant in each engine room. A two-shaft arrangement of machinery was adopted in the yacht Narcissus, which, as previously described, gave very good results; but for powers over about 2,500 to 3,000 a two-shaft arrangement entails additional weight. On account of the greater range of expansion dealt with in the turbine, as compared with the reciprocating engines, a good vacuum is much more essential in the former than in the latter, and because of the importance of a high vacuum with the steam turbine careful consideration requires to be given to the condensing plant.

NEW VACUUM AUGMENTOR.

With a view of maintaining a high vacuum Mr. Parsons has designed a new apparatus, to assist the ordinary air pump and condenser, termed "vacuum augmentor." The augmentor consists of a small steam jet placed in the contracted portion of a pipe, led from the bottom of the condenser. The jet draws air from the condenser, and delivers it to the air pump through a small auxiliary cooler. By this means the air is reduced to a negligible quantity, and the vacuum in condensers can be higher than in the air pump, thus increasing the efficiency of the machinery. The vacuum augmentor has now been fitted in several vessels, with very good results. In the Virginian and Manxman the rise in vacuum due to the augmentor was 1¼ to 1½ inches, representing an additional economy of about 7 per cent to 8 per cent. The steam used by the jet is about 1½ per cent, leaving a net gain of about 6 per cent. The effect of an increase in vacuum of one inch at 26 inches has been found to decrease the consumption by about 4 per cent and for one inch at 28 inches about 6 per cent. By later refinements the steam used by the jet is under one per cent.

Another point which has been greatly discussed in connection with turbine machinery is the question of boiler pressure. The effect of difference of boiler pressure between 150 pounds to 200 pounds is relatively smaller with turbines than with reciprocating engines, and it is very questionable, in the majority of cases, whether the saving in coal by the adoption of high boiler pressure would justify the increase. More especially is this the case in moderate speed vessels, where the turbines are somewhat larger for the power as compared with higher speed vessels. In such cases the turbines could be designed to have their full measure of economy with boiler pressure not exceeding 150 pounds. The question of astern power was very freely criticized in the earlier vessels fitted with turbine machinery, due perhaps to the fact that the proportion of power provided for astern was somewhat on the small side. In more recent vessels a larger proportion of power has been provided, as circumstance demanded, and very good maneuvering qualities have thereby been obtained.

Other advantages incidental to the turbine might be cited, such as reduced weight of machinery, steadiness and smoothness of running, reduction in oil and stores, and absence of racing in a seaway, and other advantages which have brought the turbine to a commercial success. So rapid has been the development of the marine turbine that the Turbina Company have found it necessary to make arrangements with other builders to manufacture turbines. There are, at the present time, about 25 of the leading ship building and engineering firms in this country, in addition to foreign licensees, who have acquired the license to build Parsons' turbine engines. The Parsons turbines have also been built in Germany and fitted to a torpedo-boat destroyer and cruiser for the German government, which vessels have given very satisfactory results, and other orders have since been booked. The United States government have placed an order with the Bath Iron Works, Bath, Maine, for a scout cruiser of 24 knots speed to be fitted with the Parsons turbines, and orders for four passenger vessels have been placed with the Parsons Co.'s licensees in the States. A detailed list of turbine vessels which have been built in this country up to date shows a total horsepower actually completed of about 250,000 I. H. P. In conclusion, it may be mentioned that the total horsepower of turbine engines completed and on order with the Parsons Company and their licensees is over 800,000 I. H. P.

PERSONAL.

Charles P. Wetherbee has been elected a director of the Bath Iron Works.

Mr. Alexander Hynd, Western Reserve Building, Cleveland, will represent the National Metallic Packing Co., of Oberlin, in the marine trade at Cleveland.

Mr. Arthur Giesler has opened an office at No. 170 Broadway as a consulting engineer and will devote himself to hydro-turbine power plants and hydro-turbine pumping stations.

Wm. P. Kirk of Toms River has commenced to plank the 65-ft. houseboat he is building from designs by Cox & Stevens and will make delivery by the middle of April. The motor power will be a 25 H. P. Standard engine. This boat will only draw 24 in. and can go in any harbor or river along the coast.

The steam schooner Tamalphais was launched at the Mathews, McWhinney & Starritt ship yard at Hoquiam, Wash., recently. She was built for the E. K. Wood Lumber Co., Hoquiam, and can carry 550,000 ft. of lumber. She will also have accommodations for a few passengers.

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FIFTY MILLIONS FOR WATER WAYS.

The executive committee of the National Rivers and Harbors Congress which met on Jan. 15 and 16 last at Washington has issued a circular setting forth briefly the work transacted by the congress. Delegates to the number of 600, representing 110 commercial organizations and waterways associations and thirty-four states of the Union, attended the convention. It is the sense of the congress that $50,000,000 should be appropriated annually by the general government for the permanent improvement of navigable waterways and harbors of the country.

Agriculture and commerce, from which is derived the entire revenue of the government, has for the past ten years received less than 3 per cent of the entire annual appropriations to improve the natural and economic highways, that is to say, the rivers and harbors. War and its rewards (army, navy and pensions) receive over 40 per cent of the entire revenue. In asking for $50,000,000 for the rivers and harbors, less than 7 per cent is requested for the benefit of agricultural and commerical interests from which all the wealth of the nation is derived. Rivers and harbors bills in the past ten years have been passed every three years instead of annually and the average carried by such bills has only been $19,251,781 a year.

The National Rivers and Harbors Congress appointed an executive committee of fifteen members and charged them with the duty of actively prosecuting the work of securing a regular and increased annual appropriation for the improvements of rivers and harbors. The executive committee is as follows:

Joseph E. Ransdell, chairman, Washington, D. C., Lake Providence, La.; Wm. H. Lincoln, Boston, Mass.; Robert Ramsay, Baltimore, Md.; E. J. Hale, Fayettesville, N. C.; M. J. Saunders, New Orleans, La.; S. W. Duncan, Dallas, Texas; John A. Fox, Blytheville, Ark.; W. P. Kennett, St. Louis, Mo.; Albert Bettinger, Cincinnati, O.; W. B. Rodgers, Pittsburg, Pa.; Henry T. Clarke, Omaha, Neb.; Wm. Lorimer, Chicago, Ill.; Wm. J. Crosby, Detroit, Mich.; John W. Ferris, San Francisco, Cal.; A. H. Devere, Portland, Oregon; J. F. Ellison, secretary and treasurer, Cincinnati, O.

Resolutions were adopted as follows:

"Whereas, There has existed in the past an unjust prejudice against the appropriations recommended in Rivers and Harbors bills, in consequence of lack of information and failure to realize the enormous benefits these improvements confer upon the people of the whole country, reducing and regulating rates of freight for transportation and creating new and important channels for the conveyance of the products of the forest, field, mine and factory; and

"Whereas, The marvelous growth and development of the resources of our country and the increase of our commerce, domestic and foreign, have been the surprise and envy all civilized nations, all to be enhanced by the completion of the Panama Canal, and these demand for their successful and continuous and further extension a more liberal policy on the part of the Government; and

"Whereas, The evolution of our transportation agencies has added to and emphasized the other reasons for river, harbor and waterways improvements, the cogent one that such improvements afford a natural, proper and permanent competitive effect on the cost of transportation, invaluable to our whole citizenship.

"Therefore, Be it Resolved, That this Congress, recognizing, appreciating, and commending the invaluable work of the Rivers and Harbors Committee of the house of Representatives, and of the Committee on Commerce of the Senate, aided by the Engineer Corps of the Army, deeply regrets the limitations resulting in appropriations so small as to seriously embarrass and defeat the proper development of their labors.

"Resolved, That the National Government, having assumed the improvement and control of rivers, harbors and waterways of the country, has unequivocally bound itself to discharge these obligations promptly, by sound business methods; and instead of appropriating for the purpose at uncertain intervals of two or three years, should put river and harbor bills on a par with other great appropriation bills by annual appropriations, and direct all such work economically and continuously without the waste incident to intermittent effort.

"Resolved, That in view of the large number of projects for the improvement of our harbors, rivers, waterways and canals that have been approved by the Engineers and the Committee, requiring the expenditure of large sums of money, we not only recommend but urge an annual appropriation of at least fifty million dollars, confined to such works of development and improvement, and that until the accumulation has been cleared it is due the country that Congress take whatever steps may be required to provide the sums necessary to promptly, effectually, and economically complete accumulated worthy National projects, approved, adopted and recommended by the constituted authorities, now delayed only by lack of available funds.

"Resolved, That the Executive Committee appointed by this Congress be and is hereby directed to use all proper means to further the purposes of these resolutions, actively and in such manner as will assure the completion of these works of national development. To carry to successful completion the work outlined by the foregoing resolutions, viz: To arouse public interest to such an extent that a united demand, coming from all sections of the country for regular and adequate rivers and harbors appropriations, will induce Congress to provide an annual rivers and harbors bill of $50,000,000.00."

That the Hon. T. E. Burton, chairman of the Committee on Rivers and Harbors of the House of Representatives is in thorough accord with the work of the National Rivers and Harbors Congress is shown by the following letter from Mr. Burton to Joseph E. Ransdell:

"I regard the work of the Rivers and Harbors Congress as very helpful to the improvement of harbors and inland waterways. The work of the Executive Committee will be most helpful, if all its activity is exerted on behalf of general improvements. I sincerely hope that no special locality or project will receive special attention. I would repeat what I said in my address, that great good can be done by the diffusion of correct information and the removal of popular misapprehensions. It would be well to set before the people in carefully prepared statements the comparatively small amounts appropriated for rivers and harbors; also the benefit conferred by these appropriations. If public sentiment can be awakened and the work of the congress and its committee thoroughly understood, it will be much easier to obtain adequate appropriations for these purposes. It will be impossible to entirely ignore specific projects, though I trust the general question will be the one most considered. I should be glad to prepare for you some instances in which appropriations have been of very great benefit, if they will be of use to you."

CONTRACT FOR ANOTHER 1907 STEAMER.

The American Ship Building Co. has practically closed contract for another 7,500-ton steamer to be managed by Capt. D. Sullivan, of Chicago. She is a duplicate of the steamer recently ordered by Capt. Sullivan. This latest freighter which is to come out in the spring of 1907 will be named after the late W. E. Fitzgerald, of Milwaukee.

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BRITISH SHIPPING LETTER.

Liverpool, Feb. 26.—The directors of the Manchester Ship Canal Co. have just issued their report for the half year ended Dec. 31, 1905. The ship canal revenue receipts amounted to $1,203,455, and the expenditure to $631.485, leaving a credit balance of $571,970. The profits on the bridgewater department were $91,130. With interest and other items the total profit on the half year's working is $667,510, which has been wholly absorbed in paying interest on first and second mortgage debentures, debenture stock, and interest on Manchester corporation loan. The weight of toll-paying merchandise which passed over the ship canal during the two half-yearly periods was:

	6 months ended Dec. 31, 1904. Tons.	6 months ended Dec. 31, 1905. Tons.
Sea borne traffic.....	1,868,465	2,127,504
Barge traffic.....	145,280	132,723
Total.....	2,013,745	2,260,227

The result of the half year's working of the ship canal department was an increase of $105,980 in the receipts, of $21,785 in the expenditure, and of $84,195 in the profit as compared with the corresponding period of the previous year. Of the increased expenditure the sum of $11,885 was incurred in connection with the official opening of the new dock by King Edward in July last.

The following is a comparison of the traffic for the twelve years during which the canal has been open:

Year	Sea-borne traffic, tons.	Barge traffic, tons.	Total tons.
1894.....	686,158	239,501	925,659
1895.....	1,087,445	271,432	1,358,875
1896.....	1,509,658	316,579	1,826,237
1897.....	1,700,479	365,336	2,065,815
1898.....	2,218,005	377,580	2,595,585
1899.....	2,429,168	348,940	2,778,108
1900.....	2,784,843	275,673	3,060,516
1901.....	2,684,833	257,560	2,942,393
1902.....	3,137,348	280,711	3,418,059
1903.....	3,554,636	292,259	3,846,895
1904.....	3,618,004	299,574	3,917,578
1905.....	3,993,110	260,244	4,253,354

The receipts for the whole of the year 1905 show an increase of $156,965, and the expenditure $32,255. The net result of the year's working has been an increase in the profit of $124,710, as compared with the year 1904. The sea-borne merchandise traffic was 375,106 tons greater than in 1904, but 140,000 tons of the increase consisted of coal, on which only a small toll is payable. The canal is at present being deepened throughout to 28 ft.

King Edward on Saturday, Feb. 10, successfully launched the Dreadnought, which is to be the most powerful battleship the world has ever seen. She was only laid down in the autumn of last year, and the launch of this mammouth is an event of world-wide interest and influence, since the vessel will, besides being fitted with turbine engines, be herself as powerful as some fleets. She is said to be the product of the Japanese naval war, whose lessons are shared by Britain with her ally. Beyond the fact that gun power of enormous capacity is the guiding principle, the public is permitted to know but little. The Japanese themselves are building a similar vessel, slightly different in gun power, perhaps, but on the same lines. The Dreadnought is of 18,000 tons, and her increase in gun power will be realized from the fact that she will carry ten 12-in. guns in place of the usual four. Each of these guns fires a projectile 850 lbs. in weight, so that every minute the ship will be able to discharge 8,500 lbs. of metal from her primary batteries at a velocity sufficient to pierce the thickest armor afloat at 2½ miles. Further, she will be the first battleship driven by turbines. In eleven months' time this vessel will be the flagship of the Atlantic fleet, upon which some $50,000,000 is being spent, and when she joins that squadron, she will raise it to a position of commanding power, and one quite unapproachable on the waters. The guns will have a muzzle velocity 40 per cent greater than that of any other ordnance. She will carry 12-in. armor, and have three funnels. Her speed is to be 19½ knots to 20 knots. She will have two rudders, and her boilers will be of the Babcock water-tube type.

Sir William White, K. C. B., late constructor to the British admiralty delivered the second of his cantor lectures on Feb. 6, on "Modern Warships." He traced the development of the armor idea from its first application to the protection of ships of war to its latest. After indicating its earliest experimental use in the United States, he explained how it was first applied in a practical way to the French ships, which bombarded the Russian forts on the Crimea. For 50 years practically, he said there had been a constant struggle between gun and armor, and the struggle still proceeded. Britain had tried breech-loading guns and dropped them, chiefly because of the men's apparent inability to understand the breech block. But after a 15 years' further use of muzzle loading, they had gone back to the breech-loading with what results were known. They had tried the disposition of the armor on a ship until its general arrangement was pretty well fixed in the King Edward class, and they have changed from soft iron to compound—hard steel face, that was to say, and ductile iron back—from compound to steel, from steel to Harveyed steel, and from Harveyed steel to Krupp steel. What that meant Sir William illustrated by saying that 15 in. of soft iron was equal in resisting power to 12 in. of compound, 10 in. of steel, 7½ in. of Harveyed steel, and 5¾ in. of Krupp steel. At the close of this lecture Sir William paid a high compliment to British makers of armor plate. In 1889, when he had to build the ships authorized by the Naval Defence Act, he took the trouble to investigate the full warship building resources of the kingdom. For the ships which he had to provide in three years 31,000 tons of armor was necessary. Armor costs money—its cost, in fact, was about a fourth of the total cost of a ship, and the total cost of this 31,000 tons was about $12,500,000. He found that the total capacity of the only two armor plate manufacturers in Britain was 8,000 per annum, so he had to adopt the expedient of making armor before he made ships for it. So magnificent had been the enterprise of the great concerns at Sheffield, Manchester and Glasgow, since then, however, that today provision was visible for an output of 40,000 tons a year. Enterprise like this he thought could not be commended too highly.

Approximate dates have now been fixed for the launching of the two express Cunard steamers. For some time past, it has been common talk on the Clyde that the vessel building at Clydebank was considerably further advanced in construction than her sister ship at Wallsend, and the truth of this statement seems to be borne out by the fact that while the Clyde vessel will be launched in May, that at Wallsend will not leave the stocks till August next. The names of the boats have not yet been fixed.

An interesting point bearing on the coal consumption of turbine boats came out (says the *Glasgow Herald*) in some of the designs of the mail steamer for the Roumanian state railways. Two of the firms—one of them Messrs. Denny, of Dumbarton—offered to fit Parsons turbine driving three shafts, and guaranteed that the coal consumption would not exceed 7.716 lb. per hour for 18 knots speed, which for a vessel to carry the load of 1,500 tons is a satisfactory result. The guaranteed rate for reciprocating engines, 1.543 lbs. per horsepower per hour, works out for 7,000 horsepower at 10,801 lbs. per hour. This is comparable with the 7,716 lbs. for the turbine ma-

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chinery, so that on this showing the turbine is in the aggregate nearly 30 per cent more economical. That is the point for the owner of the ship; and here the guarantee was made with severe penalties attached. Of course, with turbines, the displacement and draught would be less as a result of the saving in weight of the machinery and as a consequence the power for 18 knots would be less, so that the rate per horsepower per hour would not show the same reduction as is the case with the aggregate per hour; but the important fact remains that, to do a given duty under given conditions, the turbine is regarded by some builders in designing channel steamers as quite 25 per cent more economical than the older type of propelling machinery.

According to the *Glasgow Herald,* the Maheno, the latest of the turbine steamers built by Messrs. Denny and Brothers, Dumbarton, for the Union Steamship Company of New Zealand, is breaking all the records on the routes on which she is sailing. She has done the trip between Sydney and Wellington in about three days, whereas not very long ago the same voyage required five days. She covered the distance from Gellibrand Light, Hobson's Bay, to Hobart, 462 miles, in 27 hours 32 minutes, and that from Hobart to the Bluff in 58 hours 35 minutes. The average up to this point was seventeen knots. Along the New Zealand coast she did still better, going from Dunedin to Godley Head, 180 miles, in 10 hours 4 minutes, and from Lyttelton to Wellington Heads, 175 miles, in 9 hours 51 minutes. In April the Maheno will make several runs from Sydney, Brisbane, Fiji, and Honolulu to Vancouver, a voyage of 7,000 miles.

THE MARINE INTERNAL-COMBUSTION ENGINE.

Alderman Sir Marcus Samuel, president of the Institute of Marine Engineers, in delivering his presidential address said that although he prided himself upon being a practical ship owner he thought he might also pride himself upon the fact that he knew little of the details of engineering. He had always found that the wisest man was he who left questions of highly technical detail to those who understood them. As he had been extremely fortunate in being closely associated with Sir Fortescue Flannery he had not felt it necessary to go personally into any details of engineering. But, fortunately, in connection with the employment of engines he had, through his business, acquired a very intimate knowledge of two factors which he ventured to say were going ahead and would have an enormous influence on the future of marine engineers. If he might venture on a word of advice to those present, he would say—make yourselves entirely masters of the construction and working of the internal-combustion engine. Let them remember that they would see exemplified in their daily lives the power of petroleum properly applied. He would like to point out a few of the enormous advantages of the internal-combustion engine. Take, for example, a sailing ship. The enormous possibility of saving labor on such a vessel was manifest, because the internal-combustion engine could be started at a single moment's notice. He supposed he would not be exaggerating when he said that it did not take two minutes to start the engine, and the moment the work was done the consumption of fuel ceased. The possibilities of its application were so great that he could hardly enumerate them all.

The industry associated with the internal-combustion engine was still in its infancy, and some interested parties had been at pains to raise a scare as to the supply of benzine. They might take it from him, however, that he saw no possibility of any demand overtaking the supply of benzine within measurable distance of time. They had practically a virgin territory in Borneo, where they were producing about 14,000 tons per week of crude petroleum, and he was very sorry to tell them that they had to destroy 4,000 or 5,000 tons weekly because they had not yet found a market for it. It remained for the marine engineers to carry the application of the internal-combustion engine into their business. He had no hesitation in saying that, seeing the troubles they had with the donkey boilers, he would fit in every one of the vessel of their fleet an internal-combustion engine. But they were faced with a great difficulty that nothing but common sense and great determination on the part of all those concerned in the use of that marvellous power would ever overcome. He referred to the outrageous restrictions which were put on the storage of benzine in this country. They did not find such restrictions in France or Germany, and he had constantly advocated that they should have a minister of commerce whose business it should be to have investigated the regulations prevailing in different countries for things which, if we had similar freedom, would aid our British manufacturers. It had been left to the Japanese to be the first to order turbines which would use steam generated by liquid fuel, and his firm had been entrusted with the order for the material for building two of the largest and fastest boats for navigating the Pacific ocean. Those boats were to be fitted with turbines, contracted for, he hoped, in this country, and they were to burn liquid fuel. His friends, the Japanese, had been very wise and very right in so deciding. The development in regard to liquid fuel in California had been stupendous. Within a few years, say two or three years, the production of liquid fuel in California had amounted to millions of tons annually. He thought that very great credit was due to the British navy, and to Sir John Dunston for being the first to move in a large sense in the use of liquid fuel. One of the greatest advantages of liquid fuel was that with perfect combustion there was not a vestige of smoke, and they could put on a turn of speed which it was quite impossible to obtain with coal.

SHIP BUILDING DURING FEBRUARY.

The bureau of navigation reports 54 sail and steam vessels of 21,580 gross tons were built in the United States and officially numbered during February, 1906, as follows:

	WOOD				STEEL		TOTAL	
	Sail		Steam		Steam			
	No	Gross	No	Gross	No	Gross	No	Gross
Atlantic and Gulf	13	2,757	15	888	5	2,520	33	6,165
Porto Rico								
Pacific	1	827	8	524			9	1,351
Hawaii								
Great Lakes			2	35	2	13,680	4	13,715
Western Rivers			8	355			8	355
Total	14	3,584	33	1,802	7	16,200	54	21,586

The Baltimore Steam Packet Co., Baltimore, Md., has given contract to the Maryland Steel Co., Sparrow's Point, Md., for the construction of a new freight steamer for the service between Norfolk and Baltimore. The steamer is to be 233 ft. 8 in. long, 33 ft. beam and 23 ft. deep, including two covered decks for freight. The machinery is to consist of triple expansion engines with cylinders 14, 30 and 50 in. diameters by 30-in. stroke, supplied with steam from two Scotch boilers, 11 ft. 6 in. diameter and 11 ft. 6 in. long. Two pole masts with fore and aft canvas are to form an auxiliary feature of this ship.

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AROUND THE GREAT LAKES.

The International Waterways Commission is meeting in Montreal during the present week.

The Pennsylvania coal docks at Sandusky have passed into the hands of M. A. Hanna & Co., of Cleveland. Mr. C. C. Hand will be in general charge of the docks.

The steamer David Z. Norton, building for Capt. W. C. Richardson, of Cleveland, at the Cleveland yard of the American Ship Building Co., will be launched on Saturday.

The Department of Commerce and Labor has issued a statement to the effect that 2,570,507 tons of coal were used on lake steamers as fuel during 1905 as against 2,143,155 tons during 1904.

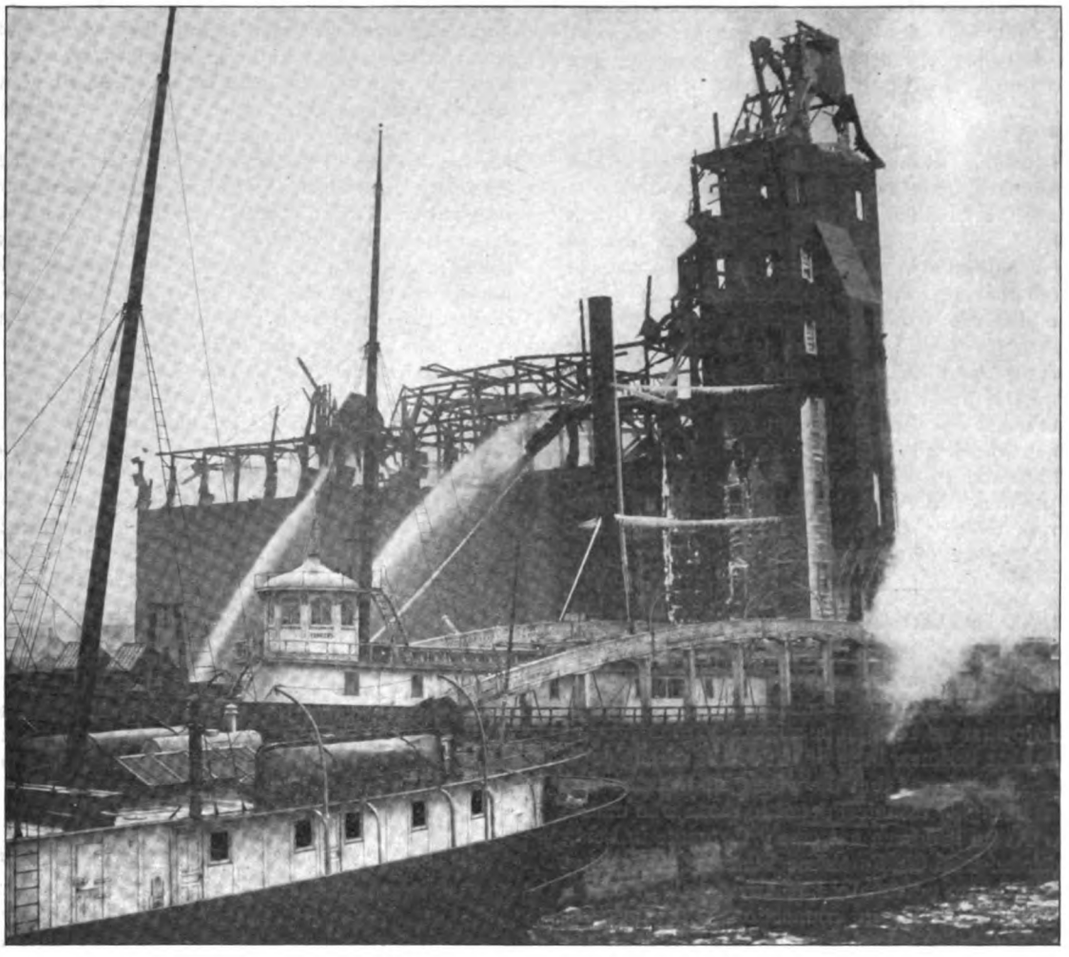
A revision in colors of coast chart No. 4, Lake Ontario, showing coast from Charlotte to Thirty-Mile Point, N. Y., has just been issued by the United States lake survey office and is for sale by the MARINE REVIEW.

A revision in colors of Coast Chart No. 7, Lake Erie, showing the west end of lake from Port Clinton, O., to Colchester, Ont., has just been issued by the United States Lake Survey Office and is for sale by the MARINE REVIEW.

A report from Toronto is to the effect that the Canadian Pacific railway has given an order to the Canadian Ship Building Co., Toronto, for a new passenger and freight steamer for its upper lake service. The new steamer is to be 350 ft. long and 44 ft. beam.

It is reported that the C. Reiss Coal Co. is planning to build an extensive new coal dock at Manitowoc. It will be 1,200 ft. long and will be located on the Wisconsin Central railroad. The dock is to include a slip 21 ft. in depth and a turning basin 750 ft. wide.

The passenger steamer City of Detroit opened navigation between Cleveland and Detroit on Monday last. This is the earliest date at which navigation opened since 1890, when the same steamer made the trip from Detroit to Cleveland on March 1. Ice was encountered but not in any considerable quantity.



RUINS OF THE WHEELER ELEVATOR WHICH WAS BURNED IN BUFFALO HARBOR, FRIDAY, MARCH 2.

The two new steamers for the Hawgoods, of Cleveland, will be named after Harvey D. Goulder and Mr. J. Q. Riddle. The Goulder will be launched at the Lorain yard of the American Ship Building Co. during the present month and the keel of the J. Q. Riddle will be laid in the berth vacated by the Goulder.

Graves & Stephens, Commercial Bank building, Cleveland, were recently awarded the contract for dredging in the Cuyahoga river by the city of Cleveland. This firm is also to place all the material over the Erie street pier to make ground for the new railroad terminals and new Union Station which is intended to be a part of the group plan.

For the loss of the Etruria which was sunk in collision with the steamer Amasa Stone owned by Pickands, Mather & Co. off Presque Isle, Lake Huron, 1905, the Hawgood Transportation Co., of Cleveland, has filed papers in the United States district court at Detroit asking $283,189.81, the largest amount ever involved in a collision suit on the lakes.

The Great Lakes Dredge & Tug Owners' Protective

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Association concluded this week a conference lasting over eight days with the representatives of the various classes of labor employed on the tugs and dredges. The workmen desired a reduction in the hours of labor but finally withdrew the demand and the settlement made with them is practically the same as last year's agreement insofar as wages and hours of labor are concerned. Some minor concessions were made, however, which improve working conditions somewhat. The wages of the dredge watchmen were increased from $50 to $60 a month but they were the only ones who secured an increase.

That a steamship company is not liable for damages when the mate of her vessel uses strenuous measures in disciplining members of the crew was the decision of Judge Page Morris in the United States district court at Duluth. The decision was made on a suit in admiralty brought by John Morgan against John Burney, of the Pittsburg Steamship Co. for $2,000, Morgan having been harshly treated by Burney when the two were at sea on the Matoa. It is asserted that Burney struck Morgan with an axe and that the master of the vessel did not interfere. The court fined the mate $150 but dismissed the case against the steamship company.

The steamer Wm. P. Snyder, building at the Ecorse yard of the Great Lakes Engineering Works for the Shenango Steamship Co., will be quite a departure in ship building as far as passenger accommodations are concerned. The forward end of the boat is fitted with a commodious observation room looking out on the forecastle deck; four passengers' staterooms and reception hall with private bath for each stateroom; captain's quarters; room for the owner or manager, and the forward crew's quarters, the latter to have shower bath. All the rooms are fitted with quartered oak. The decks will be covered with asbestolith floors made by the Asbestoliths Co., of Columbus, O.

Vesselmen in general express surprise at the fine of $1,000 imposed upon Capt. George B. Mallory, of the steamer Amasa Stone for not "standing by" and rendering assistance to the crew of the steamer Etruria in collision with the Amasa Stone last summer. Capt. Mallory is recognized as one of the ablest and most conservative masters on the lakes, and about the last thing that he would do would be to desert a vessel in distress. Capt. Mallory says that he has not been given a hearing in the case since filing his report with the local officials. He says that when the collision occurred he immediately examined his own steamer and found that she had received very slight injuries. He adds that he remained in the vicinity of the collision for two hours, blowing four whistles and all that he found during his search was the Etruria's fender streak. He then concluded that the Etruria had suffered no greater damage than his own ship and proceeded on his way. The crew of the Etruria were picked up almost immediately by the steamer Maritana, and were taken to Detour. Capt. Mallory was much surprised upon reaching Port Huron to learn that the Etruria had been lost.

AT THE HEAD OF THE LAKES.

Duluth, Minn., Mar. 5.—The barge Manila lies inside the harbor, under the protection of Minnesota point, where she was beached last Friday by the Reid company, her wreckers. The job of getting this ship into Duluth was a very difficult one, and took sixty days of hard work with a large crew of mechanics, steel workers, pumpmen and others. The ship came up the lake last Wednesday under tugs, and encountered when five miles out the first ice that had formed here this winter. It was no great obstacle, however, and way was easily made through it. There were many pumps on the barge and she was kept afloat without trouble.

The Reid company this morning inspected the Mataafa and has begun work on the Edinborn, down the shore. It is intended to free these vessels as soon as possible. The work on them will be an all-summer job and may be profitable. As far as the Manila is concerned it is not supposed among the uninitiated the ship will be worth when rebuilt very much more than she will have cost.

Grain receipts at the head of the lakes are larger than in previous winter months and way ahead of last year at this time. For February they amounted to 2,345,000 bu. against 925,000 bu. the corresponding month last year and for the past week they were 650,000 bu. against 197,000 the first week in March, 1905. It is expected they will be heavy from now on, as country elevators will be shipping in during this month.

The amount of Duluth wheat still afloat at Buffalo is surprising head of the lake shippers, who wonder why it is not coming out of vessels into store. There does not seem to be any very decided anxiety for this wheat on the part of consumers just now.

ITEMS OF GENERAL INTEREST.

The new steamer Jamestown, building for the Norfolk & Washington Steamboat Co., Washington, D. C., will be launched on March 17 at the yard of the Newport News Co., Newport News, Va.

The Nilson Yacht Building Co., of Baltimore, Md., have commenced work on a steam houseboat 83 ft. by 20 ft. by 2 ft. 6 in., designed by Cox & Stevens. This craft is designed for southern waters and will be delivered to the owner in the fall. She will have two triple-expansion engines, water-tube boiler and will make about 11 miles an hour.

The steamer Portland, which ran on Spite Island in Alaskan waters, and for a long time was abandoned as a total wreck, has at last been got off of the rocks, temporarily repaired, and will be brought down to Seattle. The vessel's damages were not very serious after all. The Portland belongs to the Alaska Commercial Co., of San Francisco, and the repairs can be made with a comparatively small outlay.

Hollis Burgess, 10 Tremont street, Boston, Mass., has sold the auxiliary yacht Edith owned by C. D. Wainwright, Marblehead, Mass., to Rodman Paul Snelling, of Needham, Mass. The Edith is a comfortable cruising boat and is equipped with a powerful Murray & Tregurtha engine. Mr. Burgess has also sold the sloop yacht Squeteague owned by the George Lawley & Son Corporation, of South Boston to C. F. Allen, of Boston.

"We dilly-dally with South American trade and are trying to build a Panama canal. What good will come of it? We have not the ships, and freight rates to the east are against it. We have not the protecting laws for a merchant marine. I myself have recognized that condition and shall certainly never again build a ship under the American flag." These were the words of James J. Hill in an interview at Lenox, Mass.

The headquarters of the passenger service of the Southern Pacific Co.'s Atlantic steamship lines from New York to New Orleans, has been transferred from Houston and New Orleans to New York, both in the operating and traffic departments. L. H. Nutting, formerly general eastern passenger agent, with headquarters at 349 Broadway, has been appointed general passenger agent and L. J. Spencer, formerly general eastern freight agent will be general freight agent of the line.

The Caldwell improved float valve, a description and illustration of which was published in the last issue of the REVIEW, is manufactured by the W. E. Caldwell Co., Louisville, Ky.

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THE NEW MITSU BISHI DRY DOCK AT NAGASAKI.

The recent completion of the new dry dock of the Mitsu Bishi Co., at Nagasaki, gives to that port what will doubtless be the largest dry dock in the east for some time to come. It has a total length on the coping, from the outer abutment to the head, of 722 ft. and a width across the body of 121½ ft. The depth of the floor below the coping is 39 ft. at the center and 36 ft. at the sides, and there is 34 ft. of water on the sill at extreme high water. Ordinary merchant vessels can be docked at any stage of the tide while the largest ships, such as the 22,000-ton Minnesota, can be docked at high tide without difficulty. The company was probably influenced somewhat in its decision to construct such a large dock by the fact that the previous absence of the facilities it affords has doubtless tended to limit the size of vessels in the Japanese trade and thereby had a restricting effect on its ship building industry. The new dock is, therefore, commercially as well as technically of much importance. The entrance was built in deep water, but the head was cut in a rocky bluff. The foundation is of andesite rock, and the concrete sub-foundation and cut-stone paving were laid directly on this firm base. Pile foundation was resorted to only for the right-hand wing wall, where the rock stratum slopes down deep into the water. The temporary dam for excluding sea water from the dock site had a top width of 12 ft. and slopes of 1:1½ with a puddle core. The clay puddle enclosed between two rows of sheet-piles was 20 ft. in thickness for the lower part, but was reduced to 12 ft. near the top.

The ground for the dam was prepared first by dredging the silt with a Priestman's dredger; a narrow trench was cut in the rock under water to receive the main piles for fixing the sheet-piles. When the main piles were set in position, they were fixed in the ground by filling the trench with concrete. To prevent the percolation of water at the junction between the base of the dam and the natural ground, as well as to take precaution against the sliding of the dam, a concrete mound about 5 ft. high was built under water, along the inside row of the main piles. After removing the silt layer, the depth of water near the middle of the dam was found to be more than 50 ft. at high tide, so that great care was taken in building this dam under water to make the puddle clay impervious at this great depth and correspondingly great water pressure. Fortunately, the execution of the work proved satisfactory, after pumping out the water.

The side cut and excavated materials was 256,000 cu. yd. The first 3 or 4 ft. from the surface was earth, but the remainder was of seamy andesite rock. It was first proposed to use rock drilling machines, but the cheapness of manual labor, and the conditions being so as to permit of employing a great number of hands, induced the contractor to resort to the old method of drilling by hand. The average cost per cubic yard was 1 yen (about 50 cents), including drilling, blasting and the subsequent removal of the debris.

For about one-third of the total length of the dock, near the entrance, the side walls were quite massive, the width of the bottom being 50 per cent of the height, but for the remaining two-thirds of the length a thickness of only 4 ft. of concrete, with 2 ft. of cut-stone masonry, was considered sufficient to line the rock cutting. In the vicinity of the sill site, any deteriorated rock surface left after excavation was carefully removed, and trenches were cut to receive the concrete sub-foundation, so that in some portions, just under the sill, for instance, the concreting is 14 ft. thick. For the main floor, however, the concrete layer upon the cleaned rock surface is only 2 ft. thick, upon which andesite cut-stone, 1 ft. thick, is laid. Cut stones are used only for the facing, coping and stepping, their backing being of concrete, so that, although the dock is, to all appearance, of cut-stone masonry, the main portion of the material is concrete. The facing near the entrance and the coping and stepping are of granite, but the other parts of the masonry lining are of a cheaper material, andesite, and, to a careless observer, the dock seems to be granite throughout.

The concrete used for important parts was of the following proportions: Portland cement 1, sand 2, gravel 4; for the most part the concrete consisted of: Portland cement 1, puzzolana 1, sand 4, gravel 8. Puzzolana, which was conveniently obtained from Goto Islands (off the coast of Nagasaki), was found to be of considerable advantage, both in reducing the cost of construction, and in improving the imperviousness of the concrete. The wing walls are of concrete blocks made dry, and sunk in position. The proportions of the ingredients for the concrete blocks were: Lime 0.25, puzzolana 1, Portland cement 1, sand 4, gravel 8.

The pump-house is 24 x 76 ft., with its floor 11 ft. 7½ in. above the main floor of the dock. The pump is 9 by 52 ft. arched with bricks, and with its bottom 22 ft. 11½ in. below the pump-house floor. The space between the arch and the floor is one solid mass of concrete which resists the upward pressure of water by its dead weight. Four cast-iron suction pipes, each 33 in. in diameter pass through this thick concrete. Four sets of 33-in. centrifugal pumps, suitable for direct coupling to electric motors, were supplied by Messrs. Gwinnes, Ltd., England. The four pumps, together, are capable of discharging 16,000,000 gal. from the dock in 3 hours, when driven by the motors, each giving out 180 B. H. P., at a speed of 230 revolutions per minute. Under ordinary conditions, three of these pumps are used, the fourth being kept in reserve. One 9-in. pump for drainage purposes, and one 6-in. charging pump, both mounted on the same bed-plate, are arranged to be driven by a belt from one motor. Motors for the pumping plant, from Messrs. Siemens Brothers, are at work on a 220-volt continuous current. The current is taken through wires in ducts from the power plant common to all the workshops.

In forming the steps to receive the side wall lining, blasting was forbidden, in order to avoid loosening the remaining rock surface. The debris was removed by baskets on shoulders, and by hand-cars on light rails. When the excavation had been made to a considerable depth, a portion of rock was left at the middle of the dock to serve as an incline, and a winding engine pulled the hand-cars up to the surface of the ground. A number of women were employed on this work.

The innovation of using modern excavators, locomotives, machine drills, etc., may be suggested. No doubt the use of machines becomes economical when the amount of work is large enough to make the unit cost (including the machine's first cost) less than cheap manual labor, but when one considers the local circumstances of the delay, the increased cost of importing the machines, the time required to train men in their proper use, and, further, the exceedingly cheap labor, say 20 to 25 cents per day, and the small amount of work to be done, there is not always an advantage in the use of machines. This was the case in the excavation of this dock.

The estimated cost of construction for the dock proper at the beginning of the work was as follows: Temporary dam, together with its removal, 135,000 yen; side cutting, 90,000 yen; dock excavation, 120,000 yen; cut-stone masonry, 335,000 yen; concreting, 263,000 yen; building sheds, 21,000 yen; pumping during construction, 11,000 yen; timber works, 22,000 yen; puddling side of back walls, 6,000 yen; tools, 25,000 yen; sundries, 72,000 yen. Total 1,100,000 yen.

Engine Wanted.

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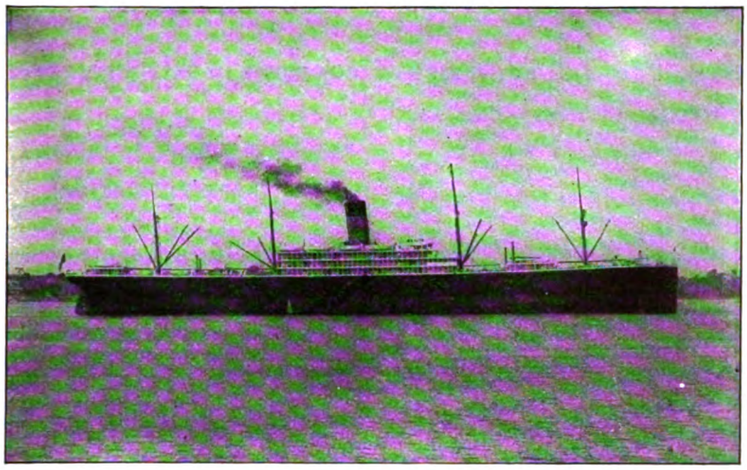

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Mietz, Aug. .....New York.
Thropp & Sons, John E.....Trenton, N. J.

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American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Chicago Ship Building Co.....Chicago.
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Detroit Ship Building Co.....Detroit.
Fletcher, W. & A. Co.....Hoboken, N. J.
Fore River Shipbuilding Co....Quincy, Mass.
Great Lakes Engineering Works.Detroit, Mich.
Hall Bros. .....Philadelphia.
Lockwood Mfg. Co.....East Boston, Mass.
Maryland Steel Co.....Sparrows Point, Md.
Mietz, Aug.....New York.
Milwaukee Dry Dock Co.....Milwaukee.
Mosher, Chas. D.....New York.
Moulton Steering Engine Co.....New York.
Newport News Ship Building Co.....
.....Newport News, Va.
New York Shipbuilding Co....Camden, N. J.
Northwestern Steam Boiler & Mfg. Co...
..... Duluth, Mich.
Quintard Iron Works Co.....New York.
Roach's Ship Yard.....Chester, Pa.
Sheriffs Mfg. Co.....Milwaukee.
Superior Ship Building Co....Superior, Wis.
Thropp, J. E. & Sons Co.....Trenton, N. J.
Trout, H. G.....Buffalo.

ENGINE ROOM TELEGRAPH, CALL BELLS, ETC.
Cory, Chas. & Son.....New York.
Marine Mfg. Supply Co.....New York.

ENGINEERING SPECIALTIES AND SUPPLIES.
Kieley & Mueller .....New York.
Lunkenheimer Co. .....Cincinnati.
Northwestern Steam Boiler & Mfg. Co...
..... Duluth, Minn.

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Hynd, Alexander .....Cleveland.
Hunt, Robt. W. & Co.....Chicago.
Kidd, Joseph.....Duluth, Minn.
Mosher, Chas. D.....New York.
Nacey, James .....Cleveland.
Roelker, H. B. .....New York.
Wood, W. J. .....Chicago.

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Greacen-Derby Engineering Co.....
.....Perth Amboy, N. J.
Ross Valve Co.....Troy, N. Y.

FIXTURES FOR LAMPS, OIL OR ELECTRIC.
General Electric Co.....Schenectady, N. Y.

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Sutton Co., C. E.....Toledo, O.

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FLUE WELDING.
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Chase Machine Co.....Cleveland.

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Lunkenheimer Co. .....Cincinnati.

GAUGES, WATER.
Lunkenheimer Co. .....Cincinnati, O.

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General Electric Co.....Schenectady, N. Y.

GRAPHITE.
Dixon Crucible Co., Joseph..Jersey City, N. J

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